MONTANA

CHAPTER 3

AFFECTED ENVIRONMENT

CHAPTER 3: AFFECTED ENVIRONMENT

Introduction

This chapter contains a description of the natural resources, economic, and social conditions found in the planning area and within the two Indian reservations adjacent to the planning area.

Air Quality

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is affected by local topography and meteorology. In the mountainous western U.S., topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. In general, local effects are superimposed on the general synoptic weather regime and are most important when the large-scale wind flow is weak.

Topography

The coalbed methane (CBM) emphasis area is located in the northern portion of the Powder River Basin of the northwestern Great Plains Steppe in southeastern Montana. The Great Plains Steppe is a large physiographic province extending throughout most of eastern Montana, Wyoming, and Colorado, as well as portions of western North and South Dakota, Nebraska, Kansas, and the Oklahoma panhandle. The topography of the CBM emphasis area varies from moderately steep to steep mountains and canyons in the western portions, to rolling plains and tablelands of moderate relief (with occasional valleys, canyons, and buttes) in the eastern regions. Elevations generally range from about 3,000 to 7,000 feet above mean sea level, with mountain peaks rising to over 10,000 feet in the southwestern portion of the CBM emphasis area.

Climate and Meteorology

Because of the variation in elevation and topography throughout the CBM emphasis area, climatic conditions will vary considerably. Most of the area is classified as a semiarid cool steppe, where evaporation exceeds precipitation, with relatively short warm summers and longer cold winters. On the plains, average daily temperatures typically range between 5 to 10 (low) and 30 to 35 (high) degrees Fahrenheit in mid-winter, and between 55 to 60 (low) and 85 to 90 (high) degrees Fahrenheit in mid-summer. The frost-free period (at 32 degrees Fahrenheit) generally occurs for 120 days between late May and mid-September. The annual average total precipitation is nearly 12 to 16 inches, with 36 to 60 inches of total annual snowfall. Temperatures will generally be cooler, frost-free periods shorter, and both precipitation and snowfall greater at the higher elevations, including the mountains in the southwest portion of the CBM emphasis area.

Prevailing winds will occur from the southwest, but local wind conditions will reflect channeling (mountain and valley flows) due to complex terrain. Nighttime cooling will enhance stable air, inhibiting air pollutant mixing and enhancing transport along the valley drainages. Dispersion potential will improve along ridge and mountain tops, especially during winter-spring weather transition periods and summer convective heating periods.

Existing Air Quality

Although site-specific air quality monitoring is not conducted throughout most of the CBM emphasis area, air quality conditions are generally good and well within existing air quality standards, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches). Existing air quality throughout most of the analysis

What has Changed in Chapter 3 Since the Draft EIS?

Chapter 3 describes the affected environment. The planning area did not change between the Draft and Final EIS; however this chapter was changed to include a clearer explanation of the current air quality and hydrologic conditions, and to expand on the Geology and Minerals, and Native American sections. The Air Quality section was enhanced with modeling data. Clearer text was added to the Hydrology section to explain the complex relationships between ground and surface water. The Geology and Minerals section was expanded to include more maps of the emphasis area and a stand alone discussion of the geology. The Native American section was expanded based on the completion of the Crow Tribe of Indians and Northern Cheyenne Tribal Reports. Text throughout the chapter was revised for simpler presentation.

TABLE 3-1
ASSUMED BACKGROUND CONCENTRATIONS OF REGULATED AIR POLLUTANTS (µg/m^3)

Pollutant	Averaging Time	Background Concentrations[1]	National Ambient Air Quality Standards	Montana Ambient Air Quality Standards
Carbon monoxide (CO)	8-hours	6,600	10,000	10,000
	1-hour	15,000	40,000	26,000
Nitrogen dioxide (NO_2)	Annual	11	100	100
	1-hour	117	n/a	566
Sulfur dioxide (SO_2)	Annual	16	80	60
	24-hours	89	365	260
	3-hours	325	1,300	n/a
	1-hour	666	n/a	1,300
$PM_{2.5}$	Annual	8	15	n/a
	24-hour	20	65	n/a
PM_{10}	Annual	30	50	50
	24-hour	105	150	150

Source: Argonne (2002)
Notes:
[1] Background numbers are from Montana DEQ (MDEQ 2002) Modeling protocol (Argonne 2002)
µg/m^3 = micrograms per cubic meter
n/a = not applicable
PM_{10} fine particulate matter less than 10 microns in effective diameter
$PM_{2.5}$ fine particulate matter less than 2.5 microns in effective diameter

area is in attainment with all ambient air quality standards, as demonstrated by the data presented in Table 3-1. However, three areas have been designated as federal nonattainment areas where the applicable standards have been violated in the past: Lame Deer (PM_{10}—moderate) and Laurel (SO_2—primary), Montana; and Sheridan, Wyoming (PM_{10}—moderate). Anticipated existing contributors to pollutants within the region include the following:

- Emissions from oil and gas developments, e.g., natural gas-fired compressor engines (primarily carbon monoxide [CO] and oxides of nitrogen [NO_x])
- Coal mining
- Coal-fired power plants
- Gasoline and diesel vehicle tailpipe emissions of combustion pollutants (volatile organic compounds [VOC], CO, NO_x, fine particulate matter less than 2.5 microns in effective diameter [$PM_{2.5}$], inhalable particulate matter less than 10 microns in effective diameter [PM_{10}], and sulfur dioxide [SO_2]).
- Dust (particulate matter) generated by vehicle travel on unpaved roads and windblown dust from neighboring areas and road sanding during the winter months.
- Transport of air pollutants from emission sources located outside the region.

As part of the Air Quality Impact Assessment – Technical Support Document (Argonne 2002), monitoring data measured throughout southeastern Montana and northeastern Wyoming were assembled and reviewed. Although monitoring is primarily conducted in urban or industrial areas and may be relatively higher than expected in the rural areas of the state, the data is considered representative of existing background air pollutant concentrations throughout the CBM emphasis area. These values, presented in Table 3-1, reflect conditions where existing air pollutant sources (e.g., range fires, agricultural operations, etc.) may be impacting ambient air concentrations and so were deemed to be reasonable for use to define existing background conditions in the air quality impact analysis. The assumed background pollutant concentrations are below applicable National Ambient Air Quality Standards (NAAQS) and applicable

Montana Ambient Air Quality Standards (MAAQS) for all pollutants and averaging times, as shown in the table.

Regulatory Framework

The National and Montana Ambient Air Quality Standards set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. The analysis of the proposed Alternatives must demonstrate continued compliance with all applicable local, state, tribal, and federal air quality standards. Montana's ambient standards are not applicable within the reservation but apply to adjacent areas off the reservation. Finally, although the U.S. Environmental Protection Agency (EPA) recently revised both the ozone (8-hour) and $PM_{2.5}$ NAAQS, these revised limits will not be affective until the Montana State Implementation Plan (SIP) is formally approved by EPA.

Given most of the CBM emphasis area's current attainment status, future development projects (including any proposed Alternative) which have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a regulatory Prevention of Significant Deterioration (PSD) Increment Consumption analysis under the federal New Source Review and permitting regulations. Development projects subject to the prevention of significant deterioration (PSD) regulations must also demonstrate the use of Best Available Control Technology (BACT), and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, SO_2, and PM_{10}. A regulatory PSD Increment Consumption analysis may be conducted as part of a major New Source Review, or independently. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. Finally, an analysis of cumulative impacts due to all existing sources, and the permit applicant's sources, is also required during New Source Review to demonstrate that applicable ambient air quality standards will be met during the operational lifetime of the permit applicant's operations.

Mandatory federal Class I areas were designated by the U.S. Congress on August 7, 1977, which included wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size on that date. In addition, the Fort Peck and Northern Cheyenne tribes have redesignated their lands as PSD Class I. The allowable incremental impacts for NO_2, SO_2, and PM_{10} within these PSD Class I areas are very limited. Most other locations in the country are designated as PSD Class II areas with less stringent requirements. Table 3-2 shows the relevant ambient air quality standards and PSD increment values.

This NEPA analysis compares potential air quality impacts from the proposed Alternatives to applicable ambient air quality standards and PSD increments, but comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potential impacts, and do not represent a regulatory PSD Increment Consumption Analysis. Even though most of the development activities would occur within areas designated PSD Class II, the potential impacts on regional Class I areas are to be evaluated. The Montana DEQ will perform the required regulatory PSD increment analysis during the new source review process. This formal regulatory process will include analysis of impacts on Class I and II air quality areas by existing and proposed emission sources. The activities are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any PSD Class I Area. Stringent emission controls (BACT – Best Available Control Technology) and emission limits may be stipulated in air quality permits as a result of this review, or a permit could be denied.

In addition, sources subject to the PSD permit review procedure are required to demonstrate impacts on Air Quality Related Values (AQRV) will be below Federal Land Managers' "Limits of Acceptable Change." The AQRVs to be evaluated include degradation of mountain lakes from atmospheric deposition (acid rain), visibility impacts, and effects on sensitive flora and fauna in the Class I areas. The Clean Air Act (CAA) also provides specific visibility protection procedures for the mandatory federal Class I areas designated by the U.S. Congress on August 7, 1977, which included wilderness areas greater than 5,000 acres in size, as well as and national parks and national memorial parks greater than 6,000 acres in size as of that date. The Fort Peck and Northern Cheyenne Tribes have also designated their lands as PSD Class I, although the national visibility regulations do not apply in these areas. Finally, the CAA directs the EPA to promulgate the Tribal Authority Rule, establishing tribal jurisdiction over air emission sources on both trust and fee lands within the exterior boundaries of tribal lands. Pursuant to this rule, Native American tribes may submit a "Treatment as a State" application to the EPA, requesting that they be treated in the same manner as a state under the CAA, including Section 105 grants and formal recognition as an affected "state" when permits are written for sources within 50 miles of tribal land boundaries (per 40 CFR 70.8 and 71.2). Also, the tribes can be delegated authority to establish an Operating Permits Program under Title V of the CAA, in order to issue permits for air pollutant emission sources located within the exterior boundaries of tribal lands.

TABLE 3-2
APPLICABLE AMBIENT AIR QUALITY STANDARDS AND PSD INCREMENT VALUES (μg/m^3)

Pollutant	Averaging Time [1/]	National Primary	National Secondary	Montana	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	8-hours	10,000	10,000	26,000	n/a	n/a
	1-hour	40,000	40,000	40,000	n/a	n/a
Nitrogen dioxide	Annual	100	100	100	2.5	25
	1-hour	n/a	n/a	566	n/a	n/a
Ozone	8-hours	157	157	n/a	n/a	n/a
	1-hour	235	235	196	n/a	n/a
Sulfur dioxide	Annual	80	n/a	60	2	20
	24-hours	365	n/a	260	5	91
	3-hours	n/a	1300	n/a	25	512
	1-hour	n/a	n/a	1300	n/a	n/a
$PM_{2.5}$	Annual	15	15	n/a	n/a	n/a
	24-hours	65	65	n/a	n/a	n/a
PM_{10}	Annual	50	50	50	4	17
	24-hours	150	150	150	8	30
Lead	Quarterly	1.5	1.5	1.5	n/a	n/a

Source: Argonne (2002)
Notes: μg/m^3 = micrograms per cubic meter
[1]Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
n/a = not applicable.

Cultural and Historical

Cultural resources consist of the material remains of—or the locations of—past human activities, including traditional cultural properties (TCP) to both past and contemporary Native American Communities. Cultural resources within the planning area represent human occupation throughout two broad periods: the prehistoric and the historic. The prehistoric period is separated into the Paleo-indian Period (circa 10,000 B.C. to 5,500 B.C.), the Archaic Period (circa 5,500 B.C. to A.D. 500), the Late Prehistoric Period (circa A.D. 500 to 1750), and the Proto-historic Period (circa 1750 to 1805+). The prehistoric period began with the arrival of humans to the area around 12,000 years ago, and is generally considered to have ended in 1805 when the Lewis and Clark Expedition passed through the area. Cultural resources relating to the prehistoric period may consist of scatters of flaked and ground stone tools and debris, stone quarry locations, hearths and other camp debris, stone circles, wooden lodges and other evidence of domestic structures, occupied or utilized rock shelters and caves, game traps and kill sites, and petroglyphs, pictographs, stone cairns and alignments, and other features associated with past human activities. Some of these sites contain cultural resource features that are in buried deposits.

The historic period is characterized by the arrival of fur traders and explorers to the area and is the start of the period for which written records exist. Cultural resources within the planning area that are associated with the historic period consist of fur trading posts, homesteads, settlements, historic emigrant and stage trails, Indian war period battle sites, ranch development, railroad installations, mining operations, oil and gas fields, and Native American sites.

The following areas are designated cultural Areas of Critical Environmental Concern (ACECs):

- Powder River Resource Management Plan (RMP) area—Battle Butte ACEC is a 120-acre site in Rosebud County. Reynolds Battlefield ACEC is a 336-acre site in Powder River County.
- Billings RMP area—Pompeys Pillar is a 470-acre site in Yellowstone County. Castle Butte ACEC is a 185-acre site in Yellowstone County. Petroglyph Canyon is a 240-acre in Carbon County. The Stark Site is an 800-acre site in western Musselshell County. Weatherman Draw is a 4,268-acre site in Carbon County.

Each of these ACECs has their own management plans that include restrictions on activities and development (BLM 1999a). Two additional cultural resource sites, the Mill Iron and Powers-Yonkee sites in the Powder River RMP area, have been designated Special Management Areas (SMAs) that also have their own management plans that include restrictions on activities and development.

There are off-reservation TCPs in southeastern Montana that are currently important to Native Americans. These include ceremonial, homestead, burial, cairn, rock art, fasting, medicine wheel, medicine lodges, settlements, stone rings, Sun Dance lodges, communal kills, and battle/raiding sites as well as rivers, springs, spirit homes, and vision quest spiritual locations and landscapes that include plant collecting areas, fossil and mineral locations, paint sources, and water. For the Northern Cheyenne these include TCPs in or near Deer Medicine Rocks, Little Bighorn Battlefield, Medicine Rock Site, Chalk Buttes, locations in and around Custer National Forest, and the Tongue River Valley. Detailed descriptions of these locations and their importance to the Northern Cheyenne can be found in the "The Northern Cheyenne Tribe and its Reservation" (Northern Cheyenne Tribe 2002). Crow TCPs include the west slopes of the Pryor Mountains, Tongue River Valley, Chalk Buttes, Broadus, and Big Horn Mountains (Crow Tribe 2002).

The existence of cultural resources within a specific location is determined through examination of existing records, on-the-ground surveys, and subsurface testing of areas that are proposed for disturbance on federal and state lands. Cultural resources are evaluated if federal or state minerals are involved and, for traditional cultural properties, consultation with appointed tribal government representatives who have knowledge of and can address issues of traditional cultural significance. Section 106 of the National Historic Preservation Act (NHPA) requires an inventory of cultural resources if federal involvement is present either in terms of surface or mineral estate, federal funds, federal grant, or federal license. Consultation with federally recognized Native American tribes must also be conducted to evaluate TCPs. The Montana State Historical Preservation Officer (SHPO) maintains a register of all identified sites within each of Montana's counties as well as all sites that are listed or eligible for listing on the National Register of Historic Places (NRHP). Table 3-3 contains information about the number of cultural resource sites that have been identified to date by SHPO for each of the counties within the planning area. Also included in this exhibit is information about

the number and density of sites that are known to be located within the current area of CBM production.

A complete listing of SHPO recorded sites can be found in "An Ethnographic Overview of Southeast Montana" (Peterson and Deaver 2001) along with a listing of sites mentioned in literary sources, potential homestead locations, and spring locations.

TABLE 3-3
CULTURAL RESOURCE SITES IDENTIFIED BY SHPO WITHIN EACH COUNTY OF THE PLANNING AREA

RMP Area County	Number of Cultural Resource Sites Identified in Surveys	Number of Acres Surveyed	Number of Sites Per Surveyed 1,000 Acres	Number of Acres Within the County	Percent of County Surveyed	Extrapolated Number of Sites In the County	Extrapolated Number of NRHP Eligible Sites
Powder River RMP Area							
Carter	444	122,652	3.62	2,132,128	5.7	7,753	779-1,121
Powder River	1,460	91,500	15.96	2,109,880	4.3	33,664	3,386-4,869
Custer	700	42,211	16.58	2,425,137	1.7	40,217	4,045-5,817
Rosebud	1,465	196,576	7.45	3,213,997	6.1	23,953	2,409-3,464
Treasure	101	17,051	5.92	629,224	2.7	3,727	374-539
Subtotal	*4,170*	*469,990*	*8.87*	*10,510,366*	*4.5*	*109,314*	*10,993-15,810*
Billings RMP Area							
Wheatland	137	5,694	24.06	913,079	.6	21,969	2,210-3,177
Sweet Grass	209	24,866	8.41	1,190,833	2.0	10,009	1,006-1,447
Stillwater	257	9,417	27.29	1,154,243	.8	31,499	3,168-4,556
Carbon	919	34,326	26.77	1,319,367	2.6	35,326	3,553-5,109
Golden Valley	97	9,309	10.42	752,094	1.2	7,837	788-1,133
Musselshell	482	33,267	14.49	1,196,032	2.8	17,329	1,743-2,506
Yellowstone	801	36,700	21.83	1,693,991	2.2	36,971	3,719-5,347
Big Horn**	1,819	278,802	6.52	3,208,115	8.7	20,930	2,105-3,027
Subtotal	*4,721*	*432,381*	*10.92*	*11,427,754*	*3.8*	*181,870*	*18,292-26,302*
Additional Counties							
Blaine	1,111	89,285	12.44	2,711,111	3.3	33,738	3,394-4,880
Gallatin	810	95,682	8.47	1,682,769	5.7	14,252	1,433-2,061
Park	614	43,570	14.09	1,799,785	2.4	25,363	2,551-3,668
Subtotal	*2,535*	*228,537*	*11.09*	*6,193,665*	*3.7*	*73,353*	*7,378-10609*
Total for CBM Emphasis Area*	11,426	1,130,908	10.10	28,131,785	4.0	364,537	36,663-52,721
CBM Area Above Known Coal Reserves			10.10	7,286,144		73,590	7,396-10,648

*CBM Production Area includes portions of Big Horn, Rosebud, and Powder River counties where active coal mining is currently conducted and where non-federal CBM production wells currently exist.

**Also includes portion of Powder River Basin RMP area.

Approximately 4 percent of the planning area has been surveyed for cultural resources resulting in a total of 11,426 cultural resource properties or sites being identified. This represents an average density of 10.10 sites per 1,000 surveyed acres or, assuming an equal distribution of sites, one site per 98.97 surveyed acres. Assuming this data across the total acreage contained within the counties of the planning area yields a total of 364,535 cultural resource properties or sites that might be expected. A total of 3,297 sites have been identified in those portions of Big Horn, Rosebud, and Powder River counties that represent the area with the greatest potential for CBM production, with an average density of 6.27 sites per 1,000 surveyed acres or, assuming an equal distribution of sites, one site per 159.49 acres. Extrapolated data yields a total of 16,942 sites that might be expected within the CBM production area.

The site densities estimated above are, of course, extrapolated assuming a consistent distribution within each county. This analysis is only valid for general site number estimates and not for site location or type of site. Sites cluster based on a host of additional site location information such as geographical location, access to water, plant, animal and other resources, view and visibility, exposure, etc. The type of site is directly related to site location depending on the activity conducted at the site. Easily accessible geographical classification and other associated site data did not exist at the time this report was prepared and the estimates provided are the best that can be made at this time.

The data used for this analysis was based, in part, on surveys conducted more than 20 years ago. Standards for survey and recordation have changed and it is likely that the actual number of sites and their relative density is higher than indicated on Table 3-3. Despite these anticipated differences the general findings of this analysis are still valid.

Geology and Minerals

Montana is the site of the juxtaposition of the Great Plains with the Rocky Mountains. The rocks at the surface vary from the ancient metamorphic and igneous complexes forming the cores of some mountains to Recent sediments in the major river valleys of the state. Geology of Montana plays an indispensable role in forming the mineral resources, visual resources, and water resources of the state. The geologic history of the state has been a series of major structural events in the tectonics, or continent building of North America.

Map 3-1 is the Tectonic Element Map of the State of Montana. The map shows the locations of important basins such as the Big Horn and Williston that have trapped sediment containing coal, oil, and natural gas. The map also locates mountain ranges such as the Crazy Mountains and Black Hills that served as sources for some of the sedimentary units. Several tectonic elements will be discussed in detail including those features that affect the state's resources – The Powder River Basin, The Big Horn Basin, Big Horn Mountains, the Bull Mountains Basin, and others. These major tectonic elements control the porous reservoirs that hold the usable water, oil, and natural gas. They also control the impermeable barriers to fluid movement. These elements also control the local folds and faults that form the oil and gas fields of the state.

Montana's basins have accumulated sediments several miles in thickness; these sands, shales, and limestones form the source and reservoirs of Montana's fossil energy reserves – crude oil, natural gas, coal, and coal bed methane (CBM). In these basins, ancient sediments were buried to great depths within the earth where heating and increased pressure formed the fuels from the raw plant materials trapped in the sediments. The sedimentary basins also hold a significant portion of the water resources of the state; in the deep parts of these basins the water is generally salty while the shallower parts of these basins there is fresh water of meteoric origin.

Map 3-2 presents the statewide outcrop geology. The map emphasizes broad basin features underlying the Great Plains in contrast to the intensely contorted structures under the many mountain areas. The basins mentioned above as likely to contain CBM resources, such as the Powder River Basin, can be seen as broad expanses of similar outcrop. In the case of the Powder River Basin, rocks at the surface are all coal-bearing Tertiary formations except for the scattered Quaternary age Alluvium in stream and river valleys. Other basins contain coal-bearing sediments of Cretaceous age. The presence of large volumes of suitable coal is vital for predicting CBM development.

CBM is the focus of this EIS; it is important to recognize that the resource is intimately associated with coal deposits. The methane gas is generated by the coal deposit both under thermogenic (heat-driven) and biogenic (microbe-driven) conditions. At the same time, the methane is trapped in the coal seams by the pressure of groundwater. Releasing the pressure of groundwater from the coal aquifers liberates methane, allowing it to be produced and sold. The magnitude of the CBM resource is determined by coal type and volume; the location of coal reserves will predict the location of Montana's CBM resources.

Map 3-3 is the statewide coal occurrence map. The map displays the extent of coal deposits that support mines and are expected to support projected CBM development. The geology of Montana has given rise to several different kinds of coal; the most important differentiator is coal rank or thermal maturity. As coal is buried or otherwise heated, the raw plant material is gradually converted from complex carbon compounds to simple compounds and elemental carbon. Map 3-3 highlights coal rank or maturation ranging from lignite, sub-bituminous, high-volatile bituminous, medium-volatile bituminous, low-volatile bituminous, and anthracite coals (Leythaeuser and Welte 1969). The areas of interest are the Powder River Basin, Bull Mountain Basin, and Blaine County, which contain mostly sub-bituminous coal that has not reached a high degree of maturation. Also of interest for CBM are the Big Horn Basin and the counties of Park and Gallatin that contain medium and high volatile bituminous coal of slightly higher maturity.

According to the Montana Board of Oil and Gas Conservation (MBOGC) records, CBM has been produced only in the CX Ranch field in the Montana portion of the Powder River Basin since April 1999. Exploration solely for CBM first happened in the Montana Powder River Basin in December 1990 in the area of CX Ranch. However, the first CBM exploration in the state was in August 1990 in the Big Horn Basin where CBM was tested but never sold. In many parts of the state, coals are aquifers that contain significant amounts of groundwater and are used by residents for water needs. In order to produce the methane in the Montana part of the Powder River Basin, groundwater must be drawn off the coal aquifer. Unless groundwater is produced from the coals, methane will not be produced; water

production cannot be avoided during CBM development. This is the central conflict between CBM and traditional uses of the land; when CBM is produced, local coal aquifers are partially depleted. Depending on the area, this depletion may extend beyond the CBM producing field boundaries.

Regional Geology

The planning area of the EIS centers on the Powder River RMP area and the Billings RMP area. The planning area contains three major basinal features – Powder River, Big Horn, and Bull Mountains – and surrounding uplifted areas. All three basins were formerly broad shelfs until Laramide tectonics caused uplift in the surrounding areas. This era of uplift and mountain building contributed to sedimentary deposition and subsidence within the basins during the Late Cretaceous and Early Tertiary. The Bull Mountains Basin and Powder River Basin were one continuous basin during the depositional periods of the Cretaceous and Early Tertiary. It was post-depositional tectonics that divided the two (Stricker, 1999). The asymmetric basins are the result of a combination of sedimentary and structural subsidence with most of the fill consisting of the Fort Union Formation. The Fort Union Formation also contains most of the coals occurring in these three basins.

The Powder River Basin in its entirety covers approximately 12,000 square miles with the smaller portion in Montana (Ellis et al., 1998). The Powder River Basin is bounded to the west by the Bighorn Uplift, to the southwest and south by the Casper Arch, Laramie Mountains, and Hartville Uplift; and to the east by the Black Hills Uplift. The Miles City Arch and the Cedar Creek Anticline to the north essentially separate the Powder River Basin from the Williston Basin.

Coal has been mined in the Powder River Basin since 1865 and large-scale strip-mining has been underway since the mid-1960s when demand increased for relatively clean-burning coals (Flores and Bader 1999). Conventional oil and gas have been exploited in the Powder River Basin for more than 50 years while CBM has been only lately developed with major activity beginning in 1997 (Rice et al. 2000).

Map 3-4 depicts the outcrop geology of the Montana portion of the Powder River Basin. The map illustrates the broad geometry of the basin with the youngest Tertiary strata (Wasatch Formation) preserved in the deepest part of the basin just north of the Wyoming-Montana state line. The broad bands of the Tongue River and Lebo/Tullock members throughout most of the basin attest to the shallow dips to the east and north edges of the basin. The narrow outcrop bands on the west limb of the basin indicate that the basin is somewhat asymmetrical with steeper dips on the western side.

Map 3-5 portrays the distribution of water wells, the prospective CBM areas, and existing CBM production within the Montana portion of the Powder River Basin. The map was constructed from information in the MBMG Map 60 (Van Voast and Thale, 2001) and emphasizes those areas with thick, sub-bituminous and bituminous coal reserves. Coals are both water reservoirs and gas reservoirs and as such, CBM production will affect local aquifers and even surface water. CBM development is expected to be concentrated in the southern portion of the PR RMP area although coals exist over most of the basin and CBM coverage could prove to be greater. The water wells shown in the map could be at risk to drawdown impact from CBM development, especially those water wells completed in coal aquifers. Those aquifers at risk to CBM impact are described in the Hydrology section.

Stratigraphy

The stratigraphy of the planning area describes the age, composition, and continuity of sedimentary rocks. The sedimentary strata of the planning area extend backward in time from recent age alluvium found in stream valleys, to strata at the surface that is largely Tertiary and Cretaceous. These older formations were deposited during the Laramide orogeny that gave rise to most of the uplifted areas in Montana. Though the area contains significant thicknesses of older formations, the Tertiary age basin fills are of particular interest for coal, CBM, and groundwater production (Ellis et al. 1998). Conventional oil and natural gas occur in the older, pre-Laramide section but most coals of interest in the Powder River Basin are found in the Early Tertiary units. See Figure 3-1 for a stratigraphic interpretation of the regional geology of the Powder River Basin.

Figure 3-2 is a stratigraphic column of Upper Cretaceous and Lower Tertiary sediments in the Montana Powder River Basin. The stratigraphic column shows the continuous development of several thousand feet of sediments that include widespread sands, coals and fluvial, fine-grained sediments. The major formations are named along with major coal seams that are discussed in greater detail elsewhere. Geologic formations found at the surface of the Powder River Basin consist largely of the several members of the Paleocene Fort Union Formation, as well as the overlying Wasatch Formation in a small

corner of the basin (Rice et al. 2000). The Fort Union Formation contains the coal, seams of interest within the Montana portion of the Powder River Basin. These coals seams function as the source of the CBM, as well as aquifers carrying groundwater of varying quantity and quality. In the Powder River Basin coal seams range in depth from the surface to approximately 900 feet deep. Coal seams vary in thickness from over 50 feet and can form aggregate thicknesses over 100 feet. Coal seams in the Fort Union do not have significant matrix porosity and permeability (Gray 1987); they can act as aquifers because fluids such as water and methane are contained within the coal's fracture system, known as cleat (Montgomery et al. 2001). The fractures accumulate the fluids and allow the fluids to move horizontally and vertically.

Sediments in the Powder River Basin

Deep Formations

A number of regional geologic formations occur beneath the major basin fill units within the Powder River Basin. These formations as shown on the regional stratigraphic column in Figure 3-1, are broadly present across Montana including the Powder River Basin. Penetrations of these formations by conventional oil and gas wells have been few in the Montana Powder River Basin and hydrocarbon production is scattered. The Cretaceous age Judith River, Shannon, Eagle, and Dakota/Lakota Formations are present in the subsurface between approximately 2,200 feet below ground surface (bgs) and 9,000 feet bgs. These four sandy formations are encased and overlain by thick Cretaceous shales of the Colorado and Pierre Formations (Noble et al, 1982). Reservoir quality sands are not present everywhere within each of these formations but each could locally be a suitable disposal zone for produced CBM water. In addition, the shales of the Colorado and Pierre Formations could perhaps accept produced water under injection pressures higher than fracture pressure. Only the Shannon Formation produces gas within the Powder River Basin. The Upper Cretaceous Eagle Formation contains coals in Blaine, Park, and Gallatin counties (Nobel et al. 1982). These coals are prospective for CBM resources but currently do not produce.

Upper Cretaceous Fox Hills and Hell Creek Formations

The Fox Hills Sandstone and Hell Creek Formations are Late Cretaceous in age and underlay the Fort Union in the Montana Portion of the Powder River Basin. The formations are difficult to separate in outcrop, and can be very difficult to separate in the subsurface, depending on the area, and appear to be in hydrologic continuity. Together, the Hell Creek and Fox Hills total approximately 500 feet of non-marine coastal plain sediments that have been shed from the mountains to the east and west (Perry, 1962). They are made up of variable, shaley sands that contain some of the youngest dinosaur fossils in the world. The sands are scattered over most of Eastern Montana but are not present everywhere in the Powder River Basin; the formations crop out at the edges of the basin and are found as deep as 3,700 feet bgs near the axis of the basin in Montana (Miller 1981). The Fox Hills Formation lies conformably upon approximately 2,000 feet of Upper Cretaceous Pierre Shale. The Hell Creek is overlain by the thick Tertiary Fort Union Formation.

Paleocene Fort Union Formation

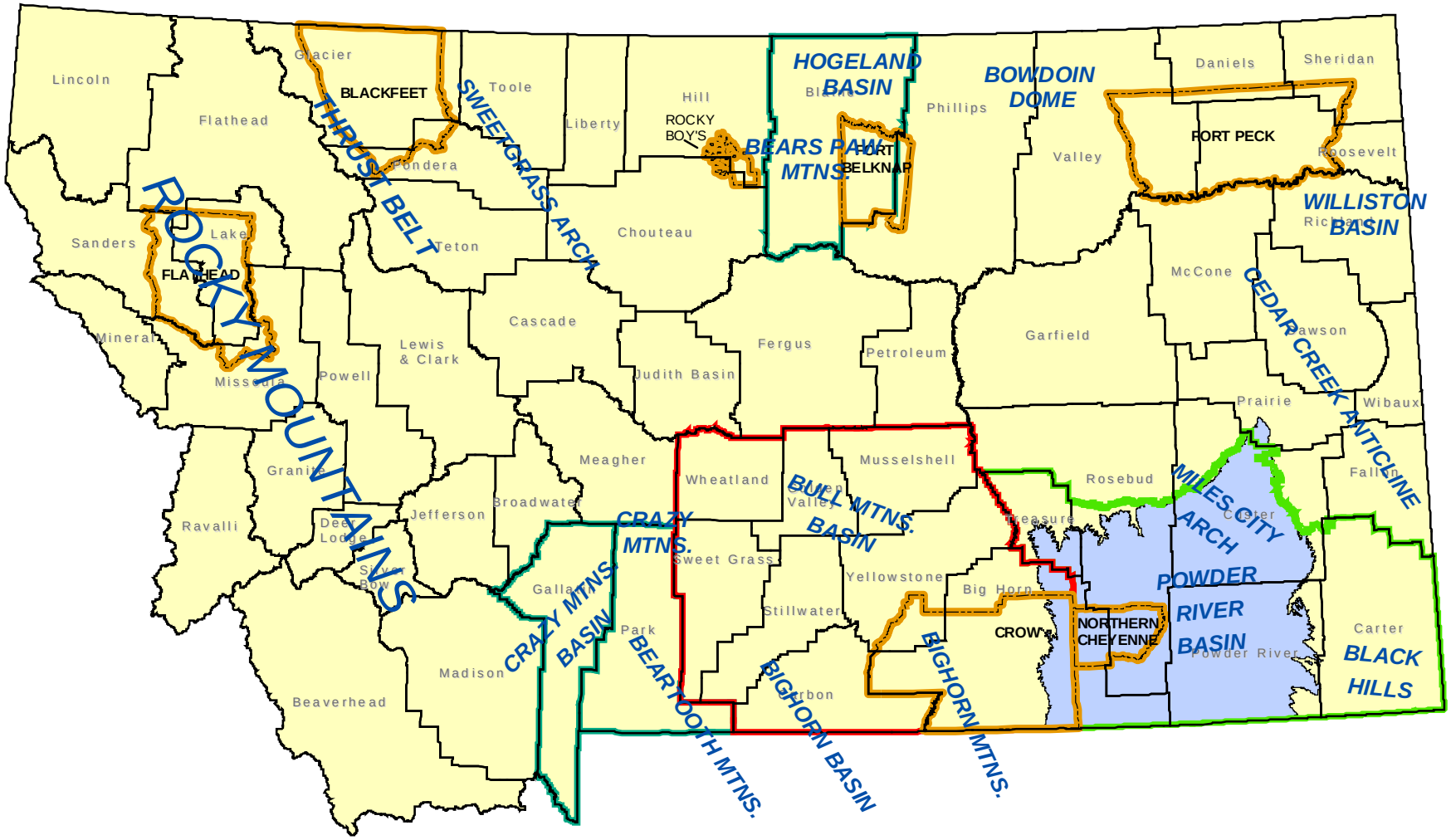
The Fort Union forms most of the sedimentary fill within the Montana Powder River Basin. It consists of approximately 3,500 feet of non-marine interbedded, sandstones, siltstones, shales and coal beds whose individual thicknesses can be as much as 37 feet near the Decker mine (Roberts et al, 1999a). The Fort Union also contains clinker deposits, formed by the natural burning of coal beds and the resultant baking or fusing of strata overlying the burning coal, which are present throughout much of the area and can be more than 125 feet thick (Tudor, 1975).

The Fort Union is split into three stratigraphic members: the lowest and oldest is the Tullock Member, overlain by the Lebo Shale Member, overlain by the Tongue River Member (McLellan et al. 1990). In the Montana portion of the Powder River Basin, the bulk of the coals are confined to the Tongue River Member, while the Lebo and Tullock Members are predominantly shale and shaley sand (McLellan et al. 1990). The Members are discussed in detail below:

The Tullock Member

This is the stratigraphically lowest part of the Fort Union, consisting of approximately 300 feet to more than 500 feet of interbedded sands and shales with minor coals near the base (Tudor 1975). The Tullock rests unconformably upon the Upper Cretaceous Hell Creek Formation throughout the Powder River Basin. While generally sandier, the Tullock is difficult to separate in outcrop and in the subsurface from the overlying Lebo Member.

Map 3-1: Tectonic Element Map of the State of Montana



Legend

- Billings RMP Area
- Powder River RMP Area
- Special Consideration Counties
- Native American Reservations
- Powder River Geologic Basin

1:4,000,000

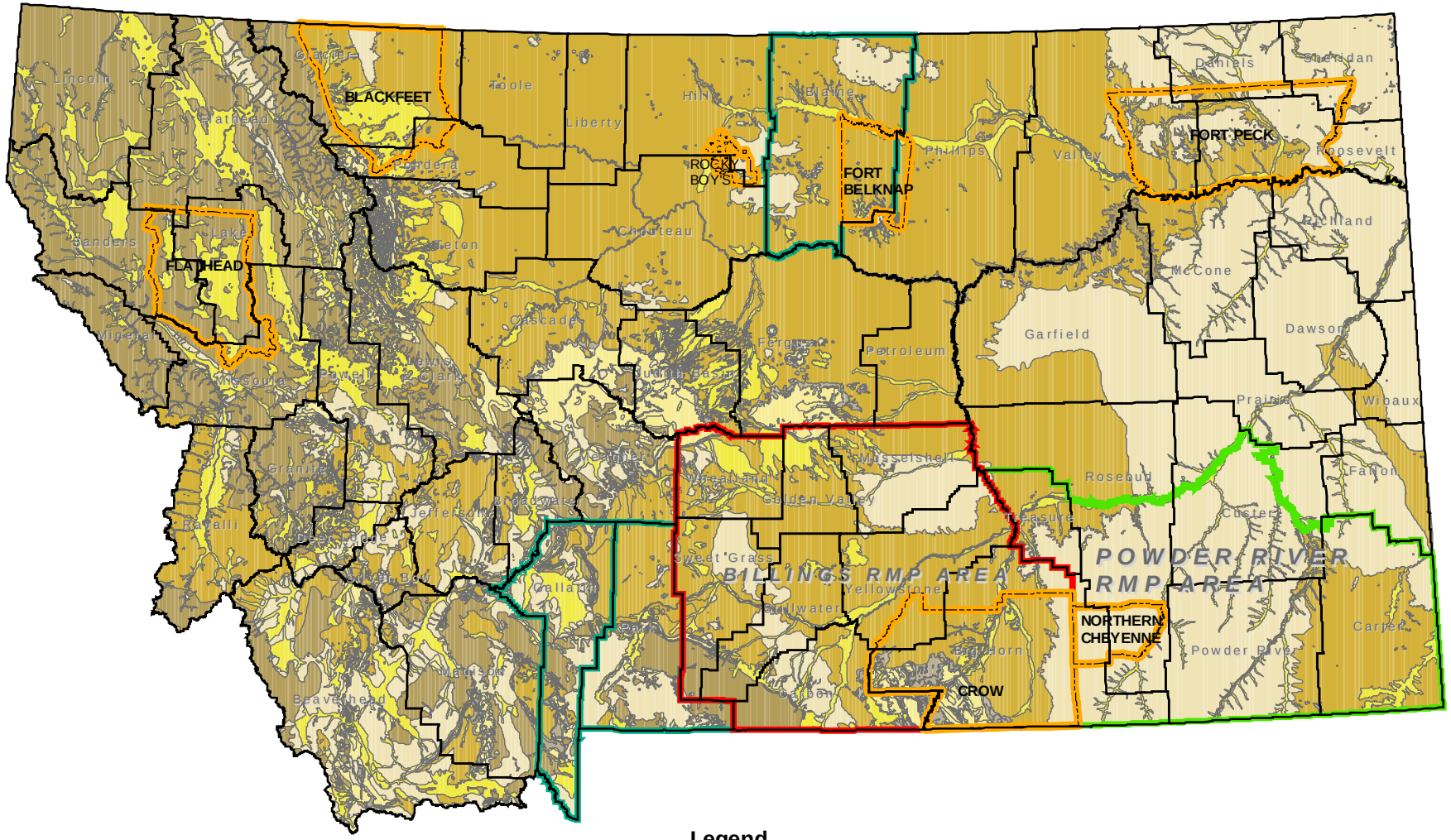
50 25 0 50 Miles

50,000 0 50,000 100,000 Meters

DATA SOURCES:

Tectonic Elements: Cohee et al, 1962.
Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana.
Reservations: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana.
Powder River Geologic Basin: 1:250,000 scale, USGS Professional Paper 1625a.

Map 3-2: Statewide Outcrop Geology



Legend

GEOLOGIC SYSTEM

- Quaternary
- Tertiary
- Cretaceous
- Triassic
- Paleozoic
- Unknown

- Billings RMP Area
- Powder River RMP Area
- Special Consideration Counties
- Native American Reservations

1:4,000,000

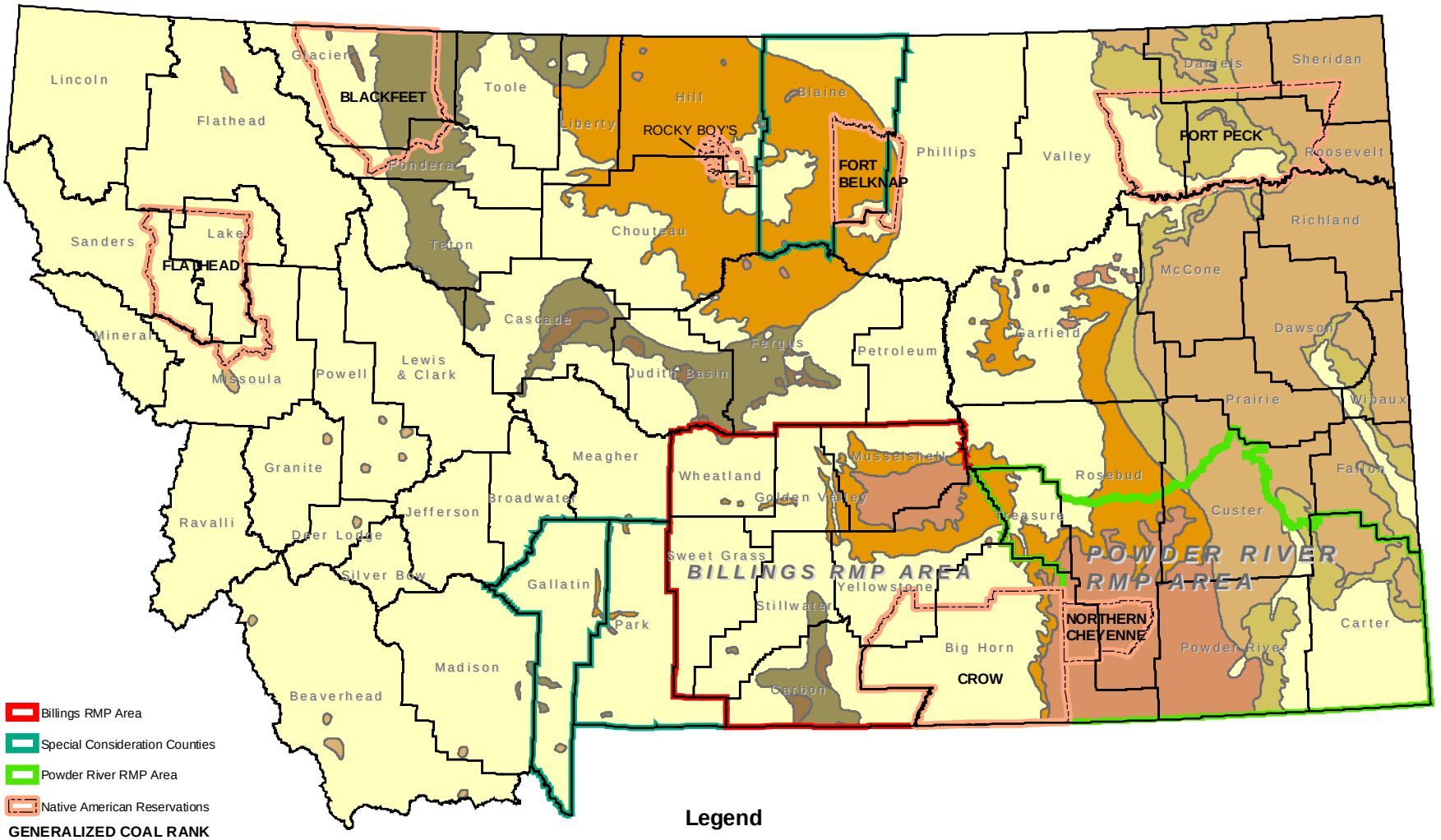
50 25 0 50 Miles

50,000 0 50,000 100,000 Meters

DATA SOURCES:

Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Reservations: 1:100,000 scale, reservations, Montana State Library/NRIS, Helena, Montana
Geology: 1:1,000,000 scale, geology, Montana State Library/NRIS, Helena, Montana
RMP Areas: BLM Miles City Field Office

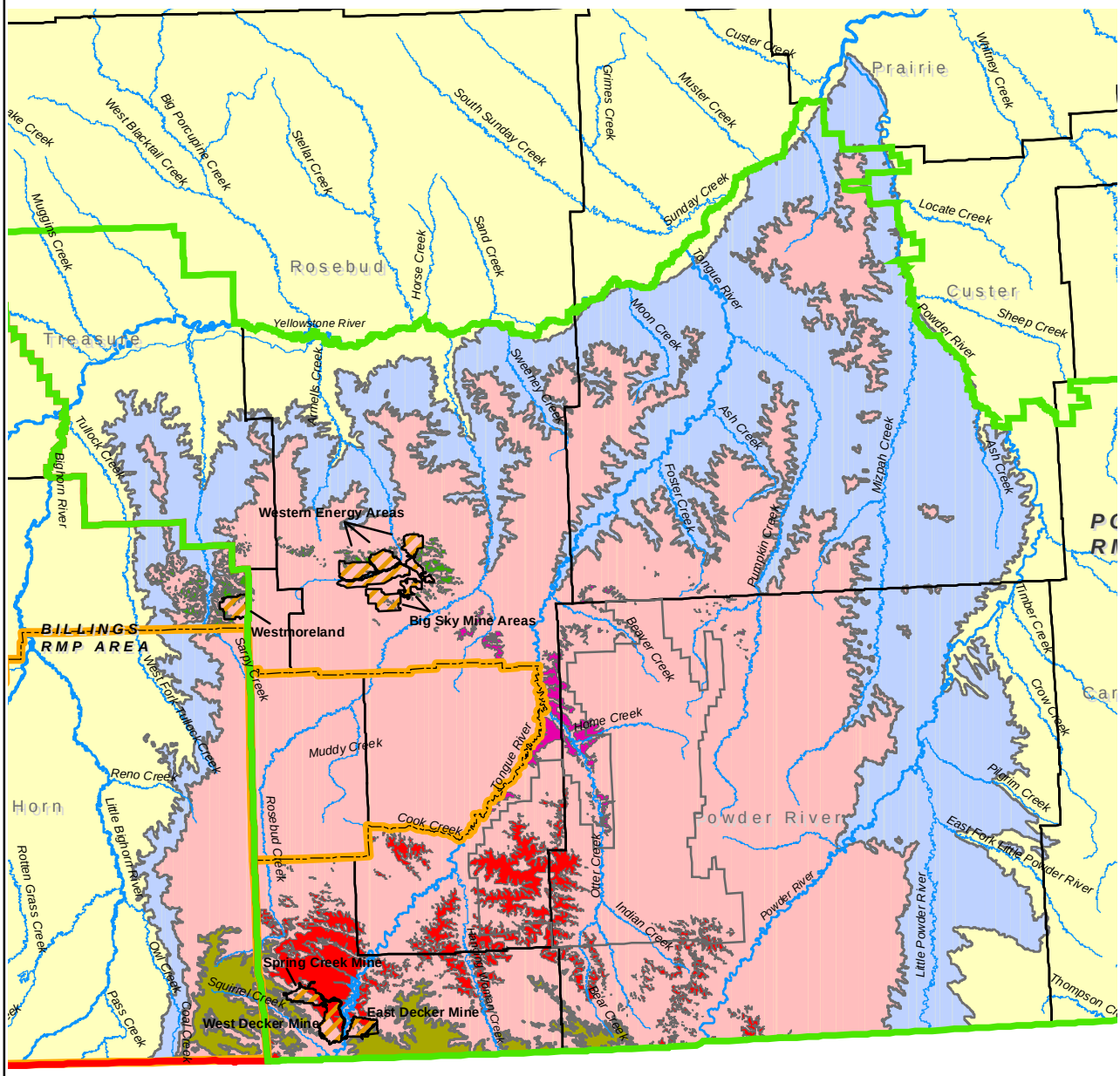
Map 3-3: Statewide Coal Occurrence Map



DATA SOURCES:

Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Reservations: 1:100,000 scale, reservations, Montana State Library/NRIS, Helena, Montana
RMP Areas: BLM Miles City Field Office.
Coal Occurrence: Tully, 1996.

Map 3-4: Outcrop Geology and Clinker Deposits of the Montana Portion of Powder River Basin



Legend

- Powder River RMP Area
- Billings RMP Area
- National Forest
- Native American Reservations
- Coal Mines

1:1,300,000

20 10 0 20 Miles

20,000 10,000 0 20,000 40,000 Meters

GEOLOGY

- Wasatch Fm.
- Tongue River Mbr.
- Lebo/Tullock Mbrs.

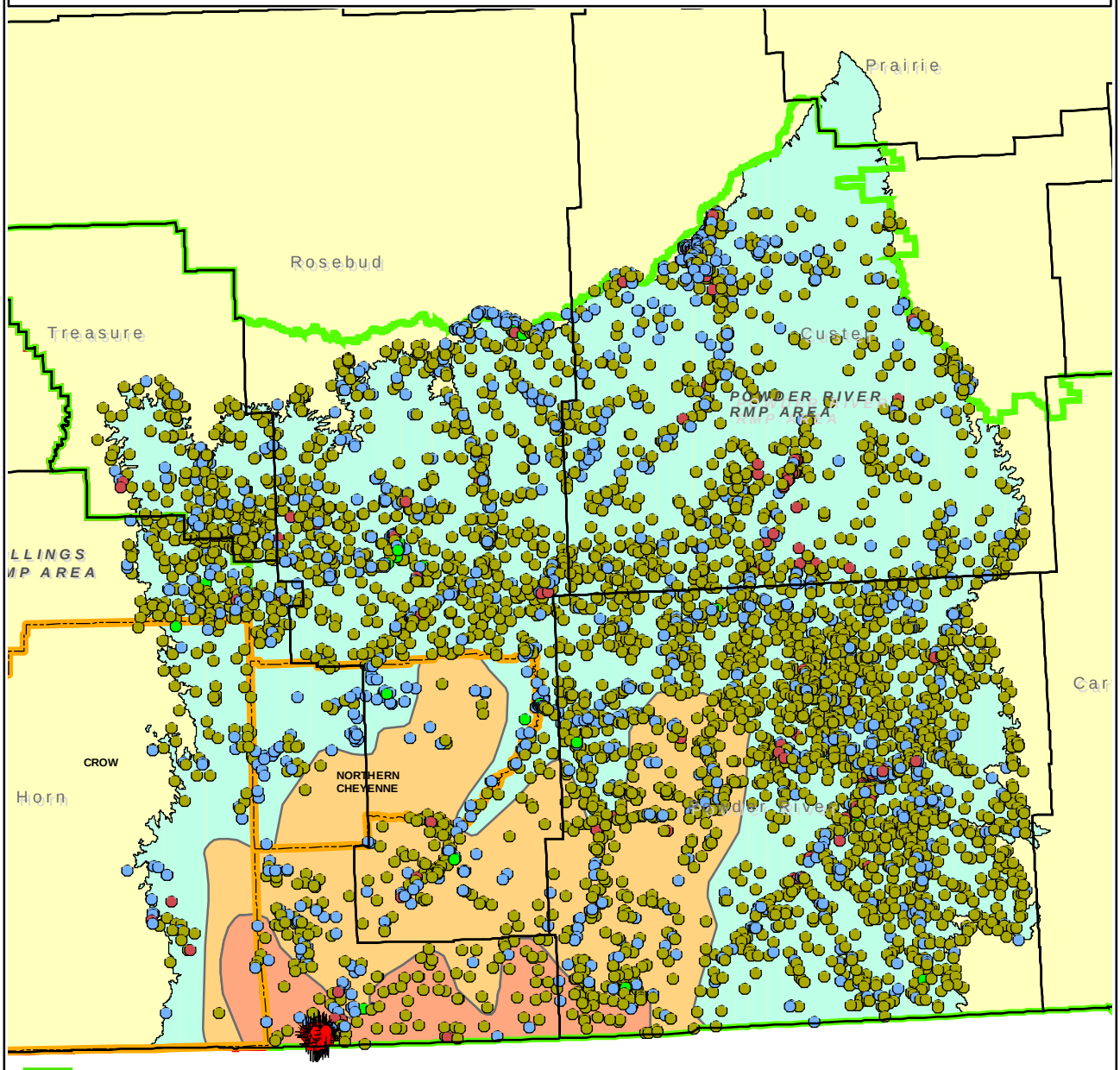
NORTHERN OUTCROP LIMIT OF COAL SEAMS WITH ASSOCIATED CLINKER

- Wyodak - Anderson Coal Clinker
- Knoblock Coal Clinker
- Colstrip Coalfield Clinker

DATA SOURCES

Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Rivers: 1:100,000 scale, rivers, Montana State Library/NRIS, Helena, Montana
RMP Areas: BLM Miles City Field Office.
Geology and Coal: 1:250,000 scale, 1999, USGS Professional Paper 1625a.
Coal Mine Boundaries: Montana Bureau of Mines & Geology

Map 3-5: Water Well Use, Current CBM Production, and CBM Likelihood in Powder River Basin



Powder River RMP Area

Billings RMP Area

Powder River Geologic Basin

Native American Reservations

WELL USE

- DOMESTIC
- IRRIGATION
- PUBLIC WATER SUPPLY
- STOCKWATER

PRODUCING CBM WELLS

- CBM

POTENIAL OF CBM DEVELOPMENT

- Higher
- Lower

Legend

1:1,300,000

20 10 0 20 Miles

20,000 10,000 0 20,000 40,000 Meters

N W E S

DATA SOURCES

Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Reservations: 1:100,000 scale, reservations, Montana State Library/NRIS, Helena, Montana
RMP Areas: BLM Miles City Field Office.
Water Well Locations: Montana Bureau of Mines & Geology Water Well Database.
CBM Potential: 1:250,000 scale, Geologic Map 60, Montana Bureau of Mines & Geology.

FIGURE 3-1 - STRATIGRAPHIC COLUMN OF THE TERIARY, MESOZOIC, AND PART OF THE PAELOZOIC SEDIMENTS IN THE MONTANA AND WYOMING PORTIONS OF THE POWDER RIVER BASIN

The column includes formations that make up CBM reservoirs and sources of water in the basin.

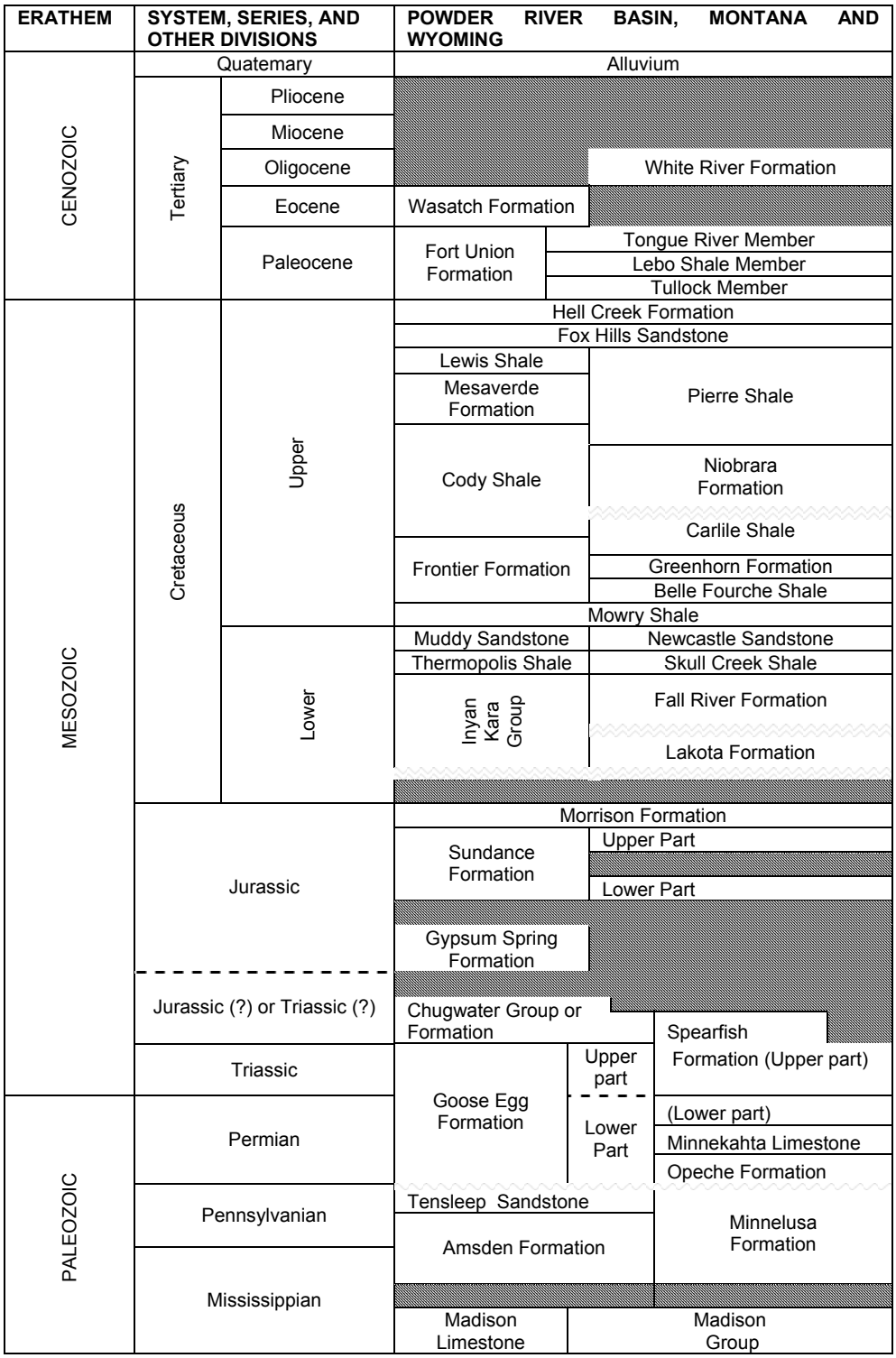


FIGURE 3-2 - STRATIGRAPHIC COLUMN OF UPPER CRETACEOUS AND LOWER TERTIARY SEDIMENTS IN THE POWDER RIVER BASIN

BEDROCK UNITS THAT FILL THE POWDER RIVER BASIN INCLUDE THE HELLCREEK, FORT UNION, AND WASATCH FORMATIONS (MODIFIED FROM RICE ET AL. 2000).

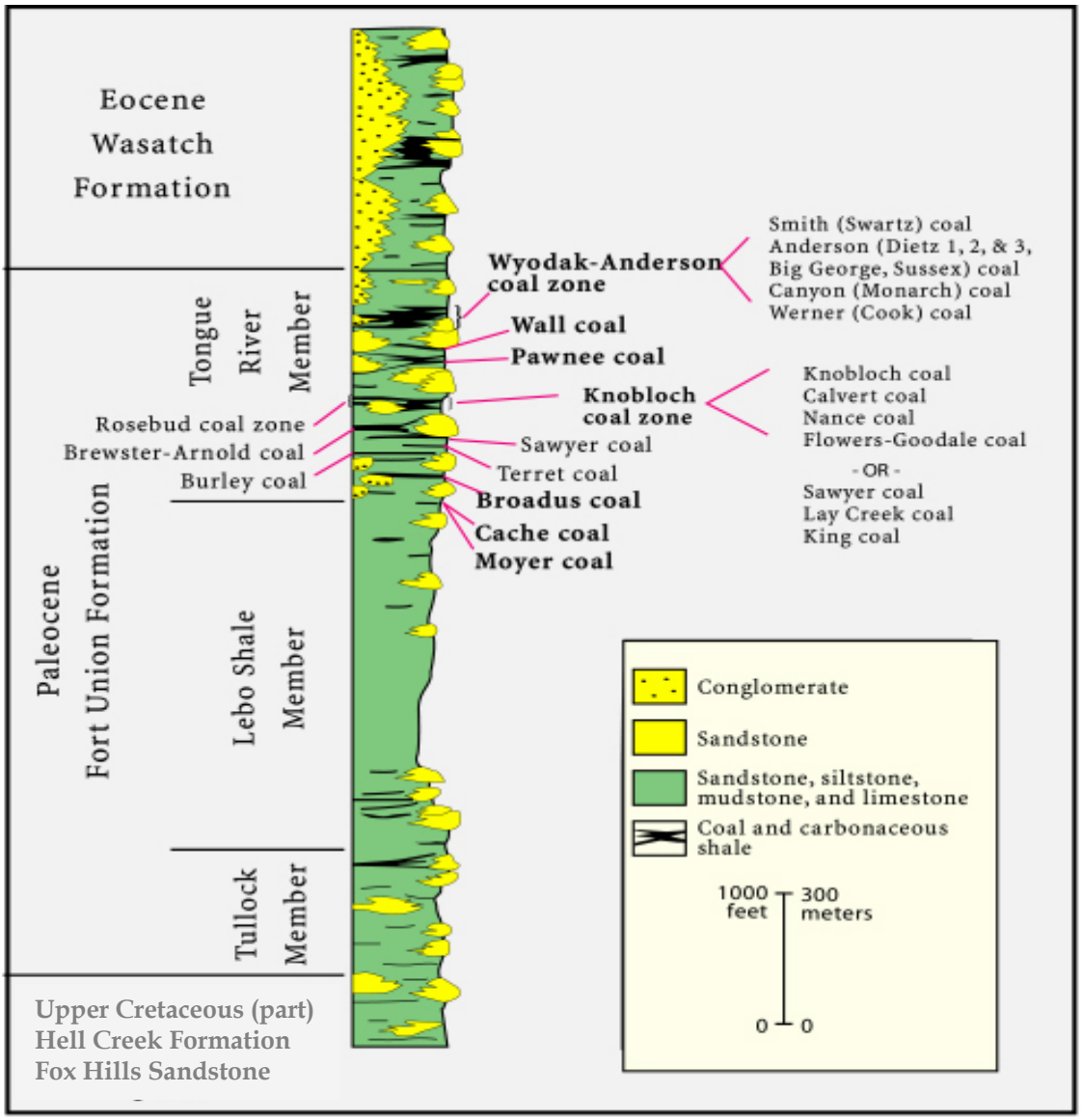
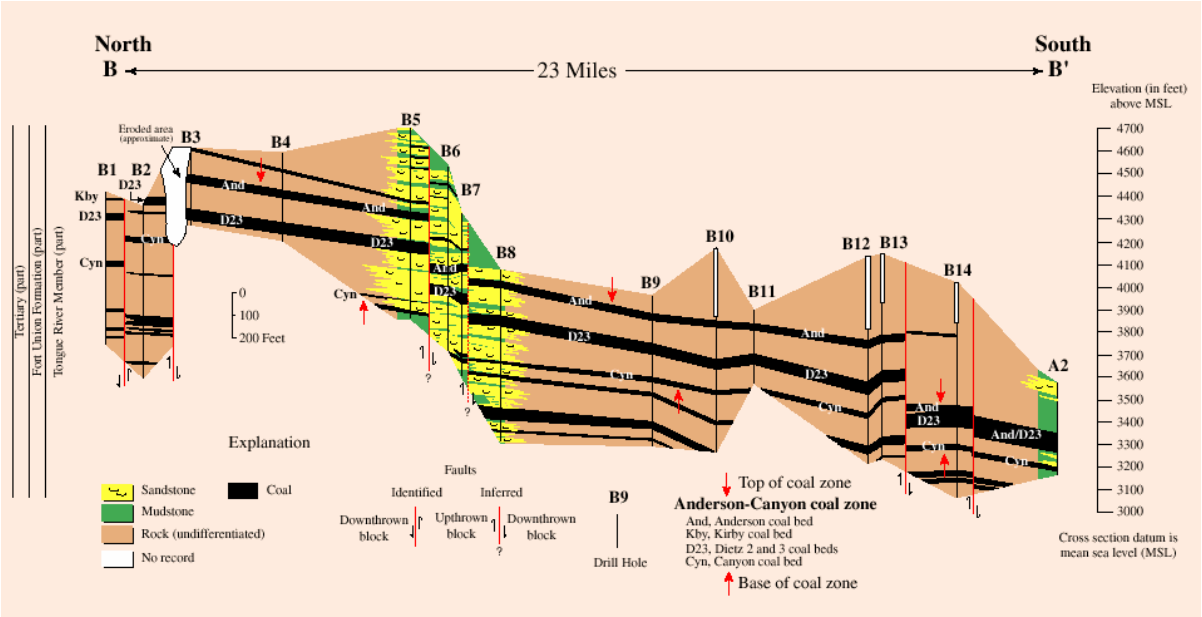


FIGURE 3-3 - STRATIGRAPHIC VARIATION OF THE ANDERSON-CANYON COALS IN THE AREA OF THE DECKER MINE, POWDER RIVER BASIN, MONTANA (ROBERTS ET AL., 1999A)

CROSS-SECTION OF LOCALIZED STRATIGRAPHY OVER A SMALL PORTION OF THE POWDER RIVER BASIN NEAR DECKER, MONTANA.



Note: this cross-section reflects localized stratigraphy over a small portion of the Powder River Basin and is not intended to be a regional reflection of the entire Montana portion of the basin.

The Lebo Member

This middle member ranges from 75 feet to more than 200 feet of claystones, limestones, and mudstones with the Big Dirty coal (3 to 13 feet of thickness) at the very base (Tudor 1975).

The Tongue River Member

The thickness of the Tongue River varies from 750 feet at the outcrop edge near the fringe of the basin to 3,000 feet near the axis of the basin (Williams 2001). The total aggregate thickness of all the coal seams ranges up to approximately 150 feet (Ellis et al. 1999b). The Tongue River Member can be locally divided into three units. The lower unit includes that portion below the Sawyer coal seam. The Middle unit includes the Sawyer through the Wall coal seam. The Upper unit includes that portion above the Wall coal seam (Ellis et al. 1999b).

The Lower Tongue River unit is present across most of the Montana portion of the basin. It includes, from the base up, the Stag, Terret, Witham, Robinson, Rosebud-McKay, Flowers-Goodale, Nance, Calvert, and Knoblach coals. In the Ashland coalfield, the Lower Tongue River unit is up to 1,660 feet in thickness, and individual coals can be up to 71 feet thick (Roberts et al. 1999b).

The Middle Tongue River unit is present over a large part of the Montana portion of the Powder River Basin. It includes, from the base up, the Sawyer, Mackin -Walker, Cache, Odell, Brewster-Arnold, Pawnee, and Wall coals.

The Upper Tongue River unit is present only in the southern part of the Montana portion of the Powder River Basin. It includes, from the base up, the Otter, Cook, Carney, Canyon, Dietz, Anderson, and Smith coals. At the Decker mine, the Upper Tongue River is up to 1,500 feet thick; coals can attain an individual thickness of 57 feet and an aggregate thickness up to 111 feet (Roberts et al. 1999a).

Although coals are the most economically significant part of the Tongue River Member, they form a small portion of the sedimentary volume. They are also extremely variable stratigraphically, as shown in the cross-section depicted in Figure 3-3. Figure 3-3 shows stratigraphic variation of the Anderson-Canyon Coals in the area of the Decker Mine, Powder River Basin, Montana.

The cross-section illustrates the continuity or lack of continuity within the stratigraphic units. Coal aquifers can be seen to have local continuity but lack regional continuity. A local coal seam such as Dietz 1 can persist for several miles but the entire Anderson-Dietz package is eroded from the Colstrip area. The stratigraphic complications documented in Figure 3-2 suggest that even thinly separated coal seams may be very dissimilar. The cross-section illustrates the pinch-outs of coal seams, bifurcating coal seams, and erosional cut-off of coal seams by Paleocene and recent stream erosion. All of these factors can play a role in complicating the production of water and methane from the Fort Union Formation.

Fort Union coals are also present in the Big Horn Basin, the Bull Mountain Basin, and Park and Gallatin counties where they are prospective for CBM resources.

Wasatch Formation

The Eocene Age Wasatch is present in the Montana portion of the Powder River Basin as fine-to medium-grained sandstone lenses and channel-fill interbedded with silstones, shales, and minor coal. The thickness of the Wasatch Formation ranges from near zero at the outcrop edge to 400 feet near the southern state boundary (Roberts et al. 1999a). It is present in outcrop in the extreme southwest corner of the basin where it overlies the Fort Union.

Quaternary Alluvium

Quaternary age sediments are those that are Pleistocene (the latest glacial episode) and Recent (post-glacial episode) in age; the sequence is dominated by events and effects associated with continental glaciation, including glacial till and exaggerated peri-glacial valley fill. Quaternary sediments in the Powder River Basin and most of the state are present as variable fill in stream and river valleys. Quaternary Alluvium consists of unconsolidated sand, silt, and gravel that make up the floodplains and stream terraces of creek valleys in the Powder River Basin (BLM 1999b). Thickness is highly variable, but maximum thickness is not expected to exceed 90 feet. Lithology is somewhat dependent on bedrock outcrop; alluvium overlying the Tertiary strata are mostly fine-grained to medium-grained sands and silts. Coarser-grained alluvium may be associated with some of the larger rivers where provenance has been outside the Powder River Basin (Hodson et al. 1973). Alluvium aquifers are largely unconfined and connected to active river flow. Because alluvial aquifers can deliver large quantities of water to wells, they are important stratigraphic features. They are also important because they are vulnerable to impact and are often connected to surface water resources. Alluvial

aquifers can be impacted by surface activity and can act as a conduit to carry those impacts to valuable surface water resources.

Powder River RMP Area

The Powder River RMP area is centered over the broad, flat-lying Powder River Basin, with basin margins rising up to the Black Hills (South Dakota) on the southeast and the Big Horn Mountains to the west. Oil production has occurred in The Powder River Basin since 1954. During 2000, eight conventional oil and natural gas fields were active in the RMP area (MBOGC 2001a). Production trends summarized in Figure MIN-1 of the Minerals Appendix (ALL 2001b) shows a sharp decline of oil production during the past 15 years caused by the aging of the several Muddy Formation fields on the edge of the basin. During the same time, conventional natural gas production from shallow Cretaceous reservoirs has increased, although it has remained at minor levels.

Billings RMP Area

The Billings RMP area centers on the Montana portion of the Big Horn Basin, the largest structural element in the area. The RMP area also includes the Big and Little Snowy and Little Belt Mountains to the north that combine to make up the Central Montana Uplift. Oil and gas is produced from the Big Horn Basin and oil is also produced from the Central Montana Uplift. Natural gas and oil were produced from 68 fields in the year 2000. Production statistics for 2000 show a 50 percent decline of both natural gas and oil production in the past 15 years, although significant quantities of both commodities are still being produced in the area (ALL 2001b).

Conventional Oil and Gas

Conventional oil and gas resources are scattered across Tertiary and older basins of the state, as well as in faulted and thrusted sedimentary rocks at the edges of some of the basins. The type of hydrocarbon fluids that are produced (oil, natural gas, or both) varies with the local geology and position in the field. Natural gas can be produced along with oil in some reservoirs or it can be produced "dry"—without associated oil. Most oil and gas reservoirs will also produce associated water. Produced water is mostly reinjected into the producing formations to maintain reservoir energy or into non-productive, salt-water bearing reservoirs although there are currently 24 surface water discharge permits that have been issued for producing conventional oil and gas fields.

- The Williston Basin produces the majority of the oil for the State of Montana and small amounts of natural gas associated with the oil; except for shallow gas fields along the Cedar Creek Anticline, little dry gas is produced.
- North-central Montana produces mainly dry natural gas from shallow fields.
- Northwestern Montana produces shallow oil with little associated natural gas.
- Central Montana produces oil with virtually no natural gas.
- The Big Horn Basin produces small amounts of both oil and natural gas.
- The Powder River Basin produces small amounts of oil at the eastern edge of the basin and very small amounts of conventional natural gas from shallow reservoirs (MBOGC 2000).

Conventional oil and gas production for the RMP areas is summarized in the Minerals Appendix of this volume.

Coal Bed Methane

CBM is a naturally occurring resource becoming very important throughout the U.S. CBM is natural gas that is generated during the geological process of converting plant material into coal through the action of burial and geothermal temperatures. Several thousand CBM wells have been completed in the Wyoming portion of the Powder River Basin while only approximately 300 CBM wells exist in the Montana portion. CBM is discussed in more detail in the Minerals Appendix of this volume and in the Water Resources Technical report (ALL 2001b) that includes numerous important references.

Coal

Coal occurs in all of the RMP areas discussed in this EIS. Coal mining has also historically occurred in Park and Gallatin counties (Roberts 1966, and Calvert 1912a and 1912b). Coal mining is underway at five mines in the Powder River RMP area, but has historically been accomplished in the Billings RMP area and Blaine County (USDL 1999). A more detailed description is included in the *Final Environmental Impact Statement, Resource Management Plan, Powder River Resource Area* (BLM 1984b). Coal resources are discussed in more detail in the Minerals Appendix of this volume.

Mineral Materials

Construction materials that are classified as saleable minerals are found in the RMP areas. These include sand and gravel, scoria, common clay, and crushed common stone not subject to regulation under the 1872 Mining Law. Descriptions of these materials are given under Mineral Materials and Locatable Minerals in the *Final Oil and Gas RMP/EIS Amendment* (BLM 1992) and in the *Final Environmental Impact Statement, Resource Management Plan, Billings Resource Area* (BLM 1983) as well as the Final EIS Amendment for the Billings, Powder River, and South Dakota Resource Management Plans of the Miles City District (BLM 1992).

Locatable Minerals

Locatable minerals are subject to provisions of the 1872 Mining Law. Minerals such as vanadium, uranium, gold, silver, gypsum, and uncommon varieties of bentonite are found in the various planning areas. Detailed descriptions of management practices for locatable minerals on federally managed lands are given in the *Final RMP/EIS* for the Billings and Powder River Resource Management Plans of the Miles City District (BLM 1983, 1984b).

Hydrological Resources

Hydrology within the planning area consists of surface water flow from several rivers and their associated tributaries, and the production of groundwater from a variety of geological formations—the combination of which comprises the aquifer systems within any specific portion of the planning area. Of particular importance to residents is the protection of surface water and groundwater in the vicinity of CBM development. CBM development typically involves the necessary and unavoidable production of large volumes of water from coal aquifers and the appropriate use or disposal of this produced water. Continuous CBM water production and disposal has the ability to impact both groundwater and surface water. As such, it is the subject of the Montana Department of Natural Resources and Conservation (DNRC) Final Order: In the Matter of the Designation of the Powder River Basin Controlled Groundwater Area. This order describes the authorities that pertain to CBM development. A copy of the order is included as an appendix to the Water Resources Technical Report (ALL 2001b). The order outlines water rights issues, mitigation, monitoring plans, and jurisdiction. Jurisdiction is summed up by this paragraph of the Order:

> "With this designation of a controlled groundwater area the withdrawal of groundwater associated with coal bed methane production will be under the prior jurisdiction of the Montana Board of Oil and Gas. However, water rights matters and hydrogeologic issues are not within the ordinary technical expertise and area of concern to the Board. These are matters ordinarily dealt with by the Montana Department of Natural Resources and Conservation and the Montana Bureau of Mines and Geology.
>
> The Montana Department of Natural Resources may petition the Board for hearings in regard to the production, use, and disposal of water from coal bed methane development wells that could effect existing water rights in the area based upon information gathered concerning water withdrawals."

Protection of groundwater will focus on maintaining beneficial uses. The coal seams are the primary aquifers for the agricultural community in southeastern Montana. In many areas, the coal aquifers supply water for livestock, wildlife, and domestic use. In the Bull Mountain coalfield, the coal seams are also used as aquifers, though to a lesser degree than in southeastern Montana. In other coal bearing areas of the State, coal seams are not used as aquifers, or that use is limited and not well documented.

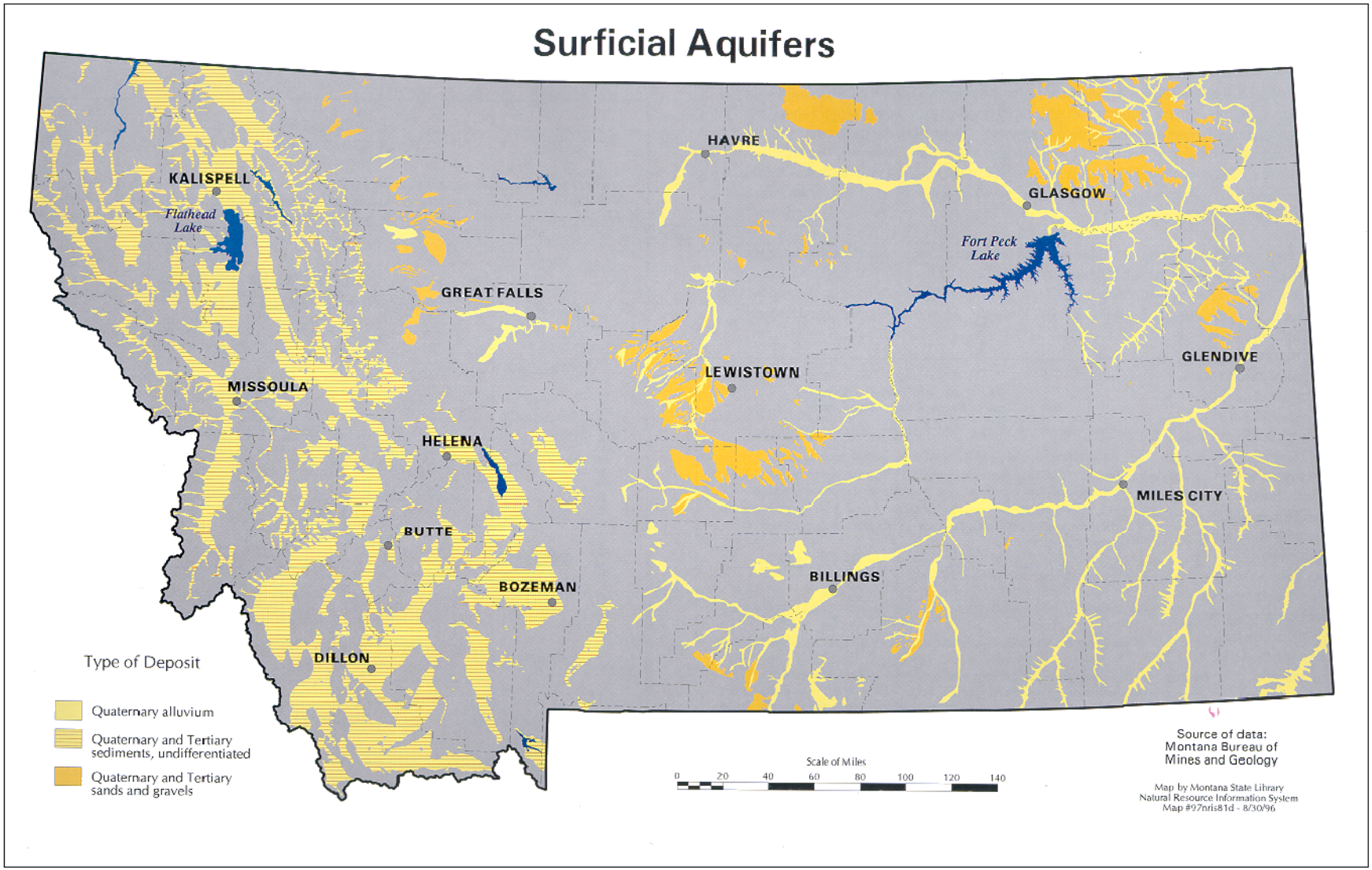
Surface Water

Surface water is the primary source of water for all uses in Montana, representing 97 percent of the water used throughout the State (Solley et al. 1995). The quality of groundwater from near-surface aquifers within the west half of the Billings RMP area, as well as in Park and Gallatin counties, is usually very good. Maps 3-6 and 3-7 show the occurrence of surficial aquifers as well as the quality of the groundwater produced from these aquifers.

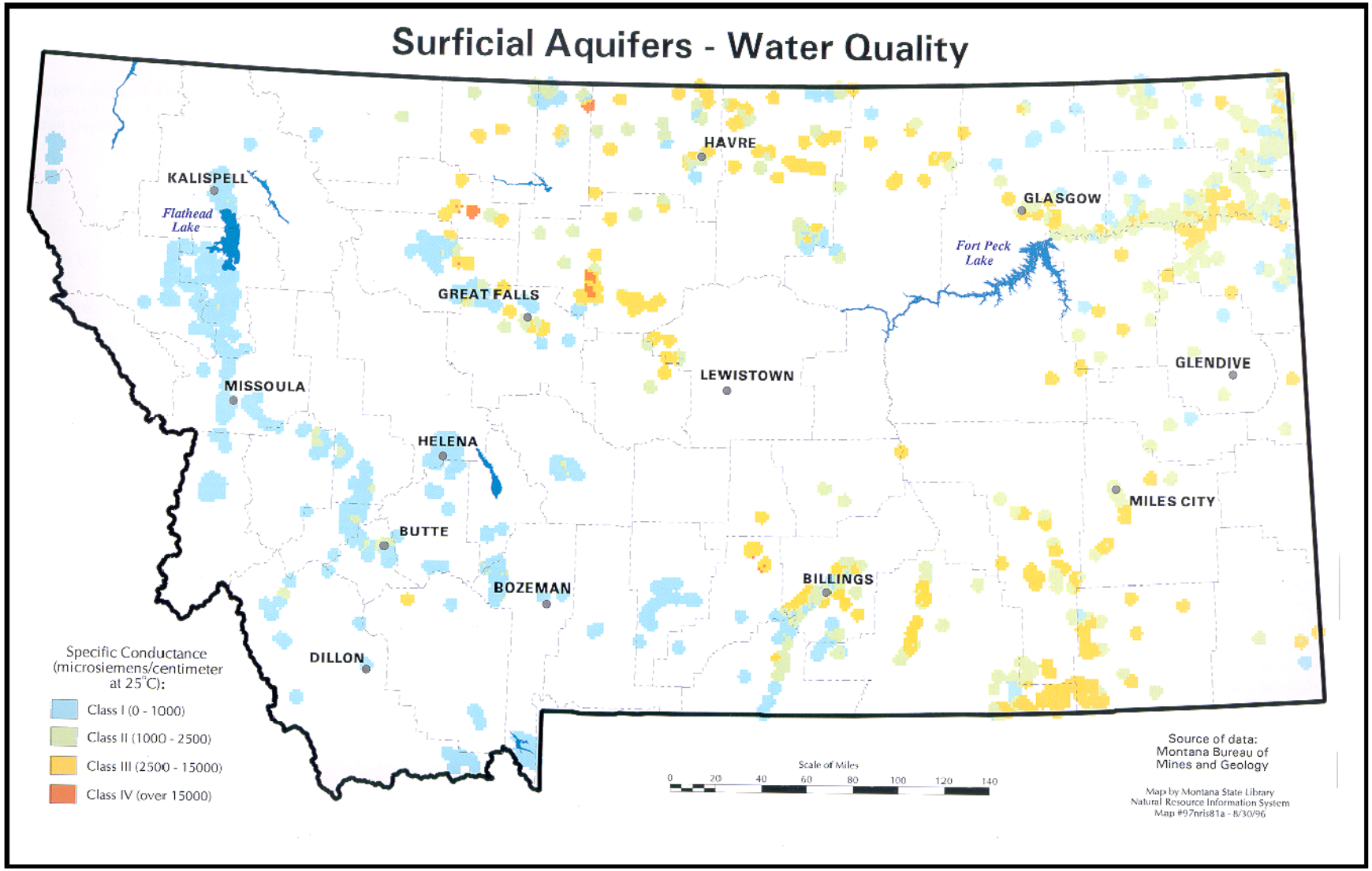
Map 3-8 shows that portion of the planning area with the greatest potential for CBM development. The map outlines those areas of continuous surface drainage termed watersheds; each watershed is drained by a single main stream element. The map emphasizes those watersheds vulnerable to impact from CBM water. The volume and quality of surface water can best be interpreted on a watershed basis. Table 3-4 lists basic data on volume and quality for the USGS stations used in the analysis of impacts to surface water in the SWQTR. This information is also summarized in Chapter 4 of this EIS and is depicted on Map 3-8.

Generally, water quality at a particular station varies inversely with flow volume. High-flow periods (Maximum Mean Monthly Flows) correspond to the seasonal influx of relatively low salinity, low SAR, meteoric waters, during spring snowmelt and early summer rains. Low-flow periods (Minimum Mean Monthly Flows) correspond to periods of scarce surface water, typically during the winter when streams are fed only by the influx of more saline, higher SAR groundwaters. Thus, high flows correspond to times of high water quality and low flows correspond to times of low surface water quality. The Tongue River near Decker illustrates this variation with a discharge rate as seen in Figure 3-4.

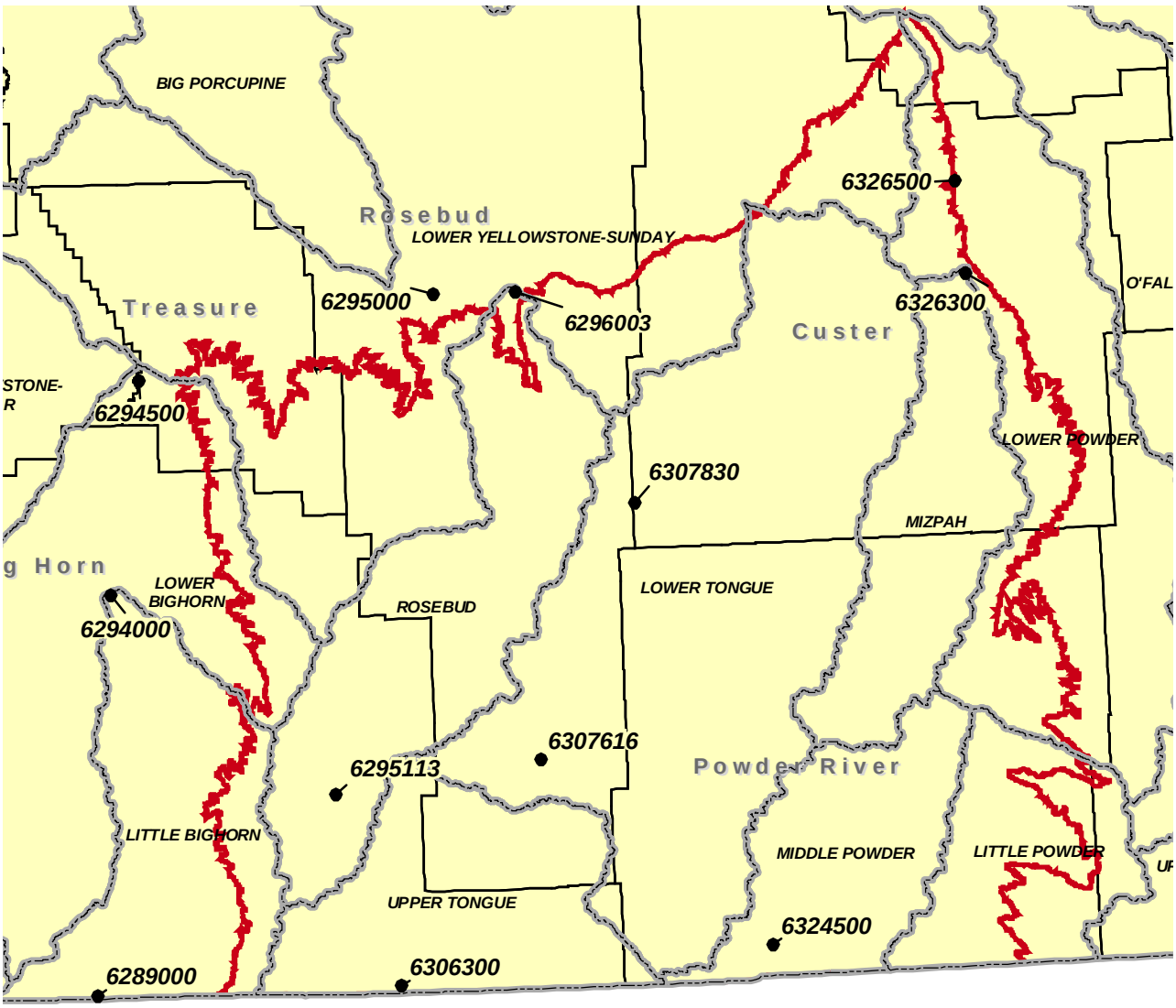
Map 3-6


Surficial Aquifers
HAVRE
KALISPELL
Flathead Lake
GLASGOW
Fort Peck Lake
GREAT FALLS
GLENDIVE
LEWISTOWN
MISSOULA
HELENA
MILES CITY
BUTTE
BILLINGS
BOZEMAN
DILLON
Type of Deposit
Quaternary alluvium
Quaternary and Tertiary sediments, undifferentiated
Quaternary and Tertiary sands and gravels
Scale of Miles
0 20 40 60 80 100 120 140
Source of data:
Montana Bureau of Mines and Geology
Map by Montana State Library
Natural Resource Information System
Map #97nris81d - 8/30/96

Map 3-7


Surficial Aquifers - Water Quality
HAVRE
KALISPELL
Flathead Lake
GLASGOW
Fort Peck Lake
GREAT FALLS
LEWISTOWN
GLENDIVE
MISSOULA
HELENA
MILES CITY
BUTTE
BILLINGS
BOZEMAN
DILLON
Specific Conductance (microsiemens/centimeter at 25°C):
Class I (0 - 1000)
Class II (1000 - 2500)
Class III (2500 - 15000)
Class IV (over 15000)
Scale of Miles
0 20 40 60 80 100 120 140
Source of data: Montana Bureau of Mines and Geology
Map by Montana State Library Natural Resource Information System
Map #97nris81a - 8/30/96

Map 3-8: Powder River Basin Watersheds and Area USGS Gauging Stations.



Legend

1:1,400,000

0 3.5 7 14 21 28 Miles

0 14,000 28,000 56,000 Meters

- USGS Gauging Stations
- Watershed Boundaries
- Powder River Geologic Basin Bnd.

DATA SOURCES:

Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, MT.
Reservations: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, MT.
National Forests: 1:100,000 scale, national forests, Montana State Library/NRIS, Helena, MT.
Parks: 1:100,000 scale, parks, Montana State Library/NRIS, Helena, MT
Development Data: BLM Reasonable Foreseeable Development Scenario
Coal Occurence: Tully, 1996.

NOTE: To be used as a reference graphic only. Some data represented are at scales greater than it's source.

TABLE 3-4
SURFACE WATER DISCHARGE AND WATER QUALITY FOR 7Q10 AND LOW MONTHLY MEAN FLOWS AT SELECTED USGS STATIONS

		7Q10 Flow			Minimum Monthly Mean Flow		
USGS Station	**USGS Station #**	**Flow (cfs)**	**SAR**	**EC µS/cm**	**Flow (cfs)**	**SAR**	**EC µS/cm**
Little Bighorn near Wyola	06289000	47	0.8	629	110	0.5	548
Little Bighorn near Hardin	06294000	21	1.6	830	123	1.0	768
Bighorn near Bighorn	06294500	870	2.8	989	1523	2.1	952
Rosebud near Kirby	06295113	0.1	1.2	1123	1.8	0.8	1016
Rosebud near Rosebud	06296003	0	---	---	8.4	4.8	1780
Tongue near Decker (stateline)	06306300	43	1.3	1179	178	0.9	731
Tongue near Birney Day School	06307616	45	1.6	1159	183	1.1	863
Tongue at Brandenburg Bridge	06307830	70	1.8	1281	207	1.4	1016
Powder at Moorhead (stateline)	06324500	0.1	6.2	4400	145	4.7	2154
Powder near Locate	06326500	1.6	6.9	3313	143	4.6	2287
Little Powder near Weston, WY	06324970	0	---	---	3.0	6.9	3300
Mizpah near Mizpah	06326300	0	---	---	0.3	16.6	3503
Yellowstone at Forsyth	06295000	2855	1.84	831	5820	2.0	745
Yellowstone near Sidney	06329500	2240	2.5	809	5764	2.0	870

7Q10 Flow = The lowest flow that would be statistically expected to occur for 7 consecutive days during any 10 year period, based on historical data.

Minimum Mean Monthly Flow = The lowest mean monthly flow for the station based on historical data.

EC = Electrical Conductance

SAR = Sodium Adsorption Ratio

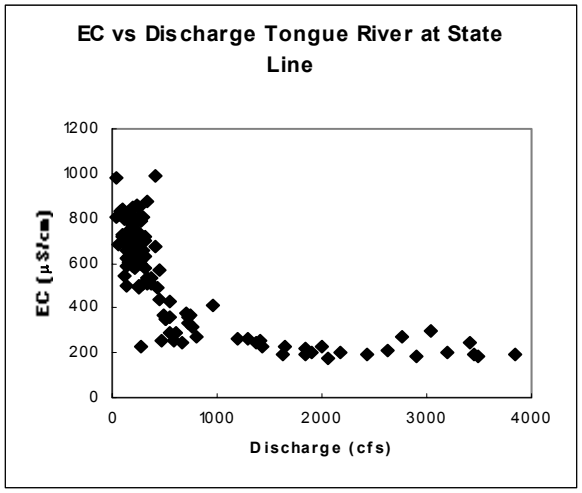
cfs = cubic feet per second

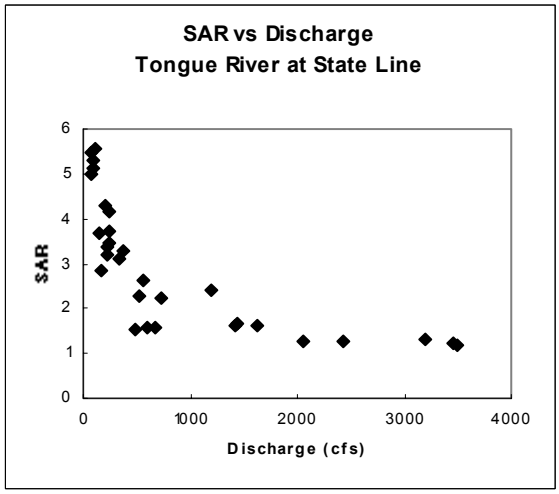
µS/cm = microseimens per centimeter

--- indicates that this value is not applicable

All water quality values shown have been determined from historical data obtained from the USGS for the flow volume in question.

FIGURE 3-4
VARIATION IN SURFACE WATER QUALITY WITH FLOW AT USGS STATION 06306300 ON THE TONGUE RIVER NEAR DECKER, BASED UPON USGS DATA FROM OCTOBER 16, 1985 TO SEPTEMBER 12, 2000





Drainage within the Powder River Basin study area is to the Little Bighorn River, Rosebud Creek, the Tongue River, and the Powder River. All of these streams flow generally north to join the Yellowstone River. The central and southern portions of the Billings RMP area are drained by a series of tributaries that also flow north-northeast into the Yellowstone River; these tributaries are the Boulder, Stillwater, Rock/Red Lodge Creeks, Clarks Fork, Bighorn, and Little Bighorn. Drainage within the northern portion of the Billings RMP area is to the Musselshell River, which flows eastward until it meets the boundary between Musselshell and Rosebud counties—at which point it turns northward and flows into the Missouri River.

The three additional counties of Park, Gallatin, and Blaine each have separate watersheds. Park County is drained by the Yellowstone River, which flows to the northeast. Much of the drainage in Gallatin County is to the Gallatin River, which flows northerly to the Missouri River. However, the eastern portion of Gallatin County is drained by streams that flow into the Yellowstone River. Blaine County is drained by the Milk River, which flows to the east and into the Missouri River.

Surface water can be impacted by cultural activity such as agriculture and industry. When groundcover is broken it exposes soil to wind and water erosion, leading to suspended sediment being brought to bodies of surface water. Artificial impoundments can cause infiltration into the soil and migration into surface water. Accidental releases of wastes can migrate into water bodies.

Watershed water-use statistics in Table 3-5 apply to those watersheds shown in Map 3-8. Table 3-5 presents data about the quantity of surface water and groundwater used in each water-use category. These data cover the area projected to have maximum CBM potential but similar data is available for other areas of the state (USGS 1995). Surface water in these watersheds is the dominate source of water, however locally groundwater use is important for public and domestic drinking water, and for stock water.

The Clean Water Act of 1972 and amendments require states to adopt standards for the protection of surface water quality. These standards are designed to maintain water quality sufficient to support the beneficial uses of the water body. Montana water bodies are classified according to the present and future beneficial uses that they normally would be capable of supporting (75-5-301 MCA). The state Water-Use Classification System (ARM 17.30.621-629) identifies the following beneficial uses:

- Drinking, culinary use, and food processing
- Aquatic life support for fishes and associated aquatic life, waterfowl, and furbearers
- Bathing, swimming, recreation, and aesthetics
- Agriculture (crop irrigation, stock watering, etc.) water supply
- Industrial (coal mining, electrical power generation, etc.) water supply

TABLE 3-5
WATER USE (IN MILLIONS OF GALLONS PER DAY [gpd]) STATISTICS IN 1995 BY WATERSHED SURFACE AND/OR GROUNDWATER USE

Watershed	Public Supply	Domes-tic	Indus-trial	Thermo-Electric	Mining	Livestock	Irrigation	Total Ground-water	Total Surface Water
Little Bighorn	0.01/0.15	0.0/0.12	0.0/0.0	0.0/0.0	0.0/0.0	0.9/0.37	84.01/1.46	2.1	84.24
Lower Bighorn	0.61/0.02	0.0/0.25	0.0/0.01	0.0/0.0	0.0/0.44	0.3/0.73	221.6/3.67	5.12	222.51
Lower Yellowstone	2.37/0.19	0.0/0.17	0.0/0.12	16.1/0.0	0.45/0.0	1.48/0.4	250/2.56	3.44	270.4
Rosebud	0.01/0.43	0.0/0.08	0.0/0.0	0.0/0.0	0.0/1.04	0.2/0.25	8.04/0.1	1.90	8.25
Upper Tongue	0.0/0.06	0.0/0.09	0.0/0.0	0.0/0.0	0.0/0.0	0.11/0.27	23.75/0.34	0.76	23.86
Lower Tongue	0.01/0.11	0.0/0.17	0.0/0.0	0.0/0.0	0.0/1.18	0.45/0.61	36.29/0.36	2.43	39.75
Middle Powder	0.01/0.12	0.0/0.04	0.0/0.0	0.0/0.0	0.0/0.0	0.02/0.24	3.18/0.04	0.44	3.21
Mizpah	0.0/0.0	0.0/0.03	0.0/0.0	0.0/0.0	0.0/0.0	0.1/0.19	6.41/0.06	0.28	6.51
Little Powder	0.0/0.12	0.0/0.04	0.0/0.0	0.0/0.0	0.0/0.0	0.05/0.24	2.18/0.03	0.43	2.23
Lower Powder	0.0/0.0	0.0/0.06	0.0/0.0	0.0/0.0	0.0/0.0	0.5/0.24	9.65/0.09	0.39	10.15

Source: USGS 1995

The current use classification of each water body in Montana was assigned on the basis of its actual or anticipated uses in the early 1970s. Water bodies are classified primarily by: 1) the level of protection that they require; 2) the type of fisheries that they support (warm water or cold water) or; 3) their natural ability to support use for drinking water, agriculture, etc. The water quality standards employed to maintain these uses address changes from natural conditions for such parameters as coliform bacteria, dissolved oxygen, pH, turbidity, temperature, color, toxics, and other harmful substances.

When streams and other water bodies are impacted by outside agents, their support of beneficial uses can become impaired. In Montana, surface water quality is tracked by the MDEQ. Table 3-6 is a compilation of impaired and threatened water bodies in need of water quality restoration. Water bodies included in this list do not currently support their original beneficial uses. This list is commonly referred to as the "303(d) List" because it is prepared in accordance with the requirements of Section 303(d) of the Federal Clean Water Act.

Several of the above watersheds and impaired water bodies are shared jurisdictionally between the State and Tribes. Segment MT42C001, the Tongue River from the reservoir to the mouth, for instance is shared between the State of Montana and the Northern Cheyenne Tribe, with the boundary lying in the middle of the river. The Lower Tongue Watershed intersects with the Northern Cheyenne Reservation. The Rosebud watershed includes most of the Northern Cheyenne Reservation and a part of the Crow Reservation; the Northern Cheyenne Reservation contacts the impaired portion of the Rosebud Creek. The Lower Bighorn watershed includes a large part of the Crow Reservation, which contacts both impaired portions of the Bighorn River. The Little Bighorn watershed includes a large part of the Crow Reservation but no water bodies are determined to be impaired on the 1996 list.

TABLE 3-6
IMPAIRED WATER BODIES IN AREA OF MAXIMUM CBM POTENTIAL

Watershed	Impaired Water body	Probable Causes of Impairment	Probable Sources of Impairment
Lower Yellowstone	Yellowstone River (MT42K001-1) from the Forsyth to the mouth of the Powder River	Metals Nutrients Other Habitat Alterations Pathogens Salinity/TDS/Chlorides Suspended Solids pH	Agriculture Irrigated Crop Production Municipal Point Sources Natural Sources Range Land Streambank Modification/Destabilization
Lower Yellowstone	East Fork of the Armells Creek (MT42KJ002-3) from Colstrip to the mouth of the West Fork of the Armells Creek	Nutrients Salinity/TDS/Chlorides Suspended Solids	Agriculture Natural Sources Range Land
Lower Yellowstone	East Fork of the Armells Creek (MT42KJ002-9) above Colstrip	Nutrients Suspended Solids	Agriculture Range Land
Lower Yellowstone	West Fork of the Armells Creek (MT42KJ002-4)	Flow Alteration Nutrients Salinity/TDS/Chlorides Suspended Solids	Agriculture Natural Sources Range Land
Lower Yellowstone	East Fork of the Sarpy Creek (MT42KJ002-2)	Salinity/TDS/Chlorides Suspended Solids	Natural Sources Resource Extraction Silviculture Surface Mining
Little Bighorn	None		
Lower Bighorn	Bighorn River (MT43P003-1) Excludes Tribal reservation Waters	Metals Salinity/TDS/Chlorides Suspended Solids Thermal Modifications pH Other Inorganics Siltation	Agriculture Flow Regulation/Modification Natural Sources Upstream Impoundments
	Bighorn River (MT43P005-1)	Metals Salinity/TDS/Chlorides Suspended Solids Thermal Modifications pH Flow Alteration Nutrients Other Inorganics	Agriculture Flow Regulation/Modification Natural Sources Upstream Impoundments
Lower Big Horn	Tullock Creek (MT43P006-1)	Metals Salinity/TDS/Chlorides Suspended Solids Nutrients	Agriculture Irrigated Crop Production Natural Sources

TABLE 3-6
IMPAIRED WATER BODIES IN AREA OF MAXIMUM CBM POTENTIAL

Watershed	Impaired Water body	Probable Causes of Impairment	Probable Sources of Impairment
		Other Inorganics	
Upper Tongue	Hanging Woman Creek (MT43B002)	Flow Alteration Metals Salinity/TDS/Chlorides	Agriculture Irrigated Crop Production Natural Sources
Upper Tongue	Hanging Woman Creek from Stroud Creek to the mouth	Siltation	Grazing and Agriculture
Upper Tongue	Tongue River Reservoir	Nutrients Organic Enrichment/DO Suspended Solids	Agriculture Municipal Point Sources
Upper Tongue	Upper Tongue River (MT43B001-1) above reservoir	Flow Alteration	Agriculture Irrigated Crop Production Natural Sources
Upper Tongue	Tongue River (MT43B001-2) from the Reservoir to mouth of Hanging Woman Creek	Flow Alteration	Agriculture Flow Regulation/Modification Irrigated Crop Production
Lower Tongue	Tongue River (MT42C001) from reservoir to the mouth	Flow Alteration Metals Other Organics Salinity/TDS/Chlorides Suspended Solids	Agriculture Flow Regulation/Modification Irrigated Crop Production Natural Sources
Lower Tongue	Otter Creek (MT42C002-2)	Metals Other Habitat Alterations Salinity/TDS/Chlorides Suspended Solids	Agriculture Highway/Road/Bridge Construction Land Development Natural Sources
Lower Tongue	Pumpkin Creek (MT43C002-6)	Flow Alteration Salinity/TDS/Chlorides Thermal Modifications	Agriculture Irrigated Crop Production
Rosebud	Rosebud Creek (MT42A001)	Flow Alteration Metals Nutrients Other Organics Salinity/TDS/Chlorides Suspended Solids	Agriculture Irrigated Crop Production Natural Sources
Mizpah	Mizpah Creek (MT42J005-1)	Organic Enrichment/DO Other Inorganics Suspended Solids	Irrigated Crop Production Natural Sources Range Land
Little Powder	Little Powder River (MT42I001)	Flow Alteration Other Organics Salinity/TDS/Chlorides Suspended Solids	Irrigated Crop Production Natural Sources Streambank Modification/Destabilization

TABLE 3-6
IMPAIRED WATER BODIES IN AREA OF MAXIMUM CBM POTENTIAL

Watershed	Impaired Water body	Probable Causes of Impairment	Probable Sources of Impairment
		Siltation	
Lower Powder	Stump Creek (MT42J004-2)	Suspended Solids	Agriculture Range Land
Lower Powder	Lower Powder River (MT42J003-1) from mouth of Little Powder to the mouth	Flow Alteration Metals Nutrients Other Organics Pathogens Salinity/TDS/Chlorides Suspended Solids	Agriculture Irrigated Crop Production Natural Sources Petroleum Activities Resource Extraction Range Land Streambank Modification/Destabilization

Source: Final Year 1996 Montana 303(d) List. A Compilation of Impaired and Threatened Water bodies in Need of Water Quality Restoration, Part A, Water Quality Assessment Results.

In accordance with Section 303(d) of the Federal Clean Water Act, the Montana Department of Environmental Quality (MDEQ) has prepared a list of impaired and threatened waters every 2 years since 1992. This so called "303(d) list" identifies lakes, rivers, and streams that are not meeting water quality standards and establishes priorities for Total Maximum Daily Load (TMDL) development. However, Montana, like the rest of the nation, was slow to develop TMDLs. On June 21, 2000, the U.S. District Court of Montana ordered EPA to work with the State of Montana to develop and adopt a schedule that would result in developing all necessary TMDLs for water bodies on Montana's 1996 Section 303(d) list (Table 3-6) by May 5, 2007. On November 1, 2000, MDEQ and EPA published a schedule that divided the state into 91 TMDL Planning Areas each with a deadline for completing all necessary TMDLs. The surface waters likely to be affected by CBM development are located in the Tongue and Powder TMDL Planning Areas. The TMDL completion dates for these planning areas are 2005 and 2006, respectively, however, based upon concern due to proposed CBM development plans, the MDEQ and EPA are currently developing TMDLs for these streams for SAR and EC. Impacted water bodies and TMDL issues are discussed in detail in the Hydrology Appendix.

Groundwater

Groundwater within the planning area is found within a variety of aquifers, ranging from shallow unconsolidated alluvial aquifers associated with modern rivers to deep bedrock aquifers consisting of consolidated sandstone, limestone, or coal. The occurrence of specific bedrock aquifers and the quality of groundwater produced from these aquifers vary throughout the planning area. Maps 3-9 and 3-10 are maps that show the occurrence of bedrock aquifers and the quality of groundwater produced from these aquifers.

Water enters the aquifers or reservoirs during deposition of the sedimentary unit as formation water that can be salty or fresh. Later, meteoric water can enter the aquifer through outcropping recharge zones where runoff water infiltrates and is conducted into the subsurface. Groundwater comes to the surface by way of natural springs that conduct groundwater onto the surface or into bodies of surface water. Aquifer pressure can be measured in pounds per square inch (psi) or in feet of head and can vary from a low-pressure reservoir where water stands below the top of the reservoir, to an artesian aquifer where water stands above the top of the reservoir, sometimes being above ground surface and flowing from wells. Aquifer pressure can be measured in a monitoring well where water is not normally produced except for testing and sampling. Groundwater can be produced through water wells that pump or convey water from aquifers to the surface.

Water quality and quantity are variable with the primary water quality issue being salinity. Groundwater represents less than 3 percent of the total water use in the State (Solley et al. 1995). Table 3-7 presents data about the quantity of groundwater used in each water-use category on a watershed basis.

Although the use of groundwater only represents 3 percent of the total water use, it is extremely critical because it provides almost 100 percent of the domestic water for farmsteads. It also constitutes the largest percentage of dependable stock water, because the groundwater is not seasonal or affected by drought, like surface water.

The major aquifers within the planning area are the alluvium, the coals and sands of the Fort Union Formation, and the Lower Hell Creek-Fox Hills Aquifer, as shown in Figure 3-5. Table 3-7 contains information about the general depth, yield, geologic materials, and water quality of all aquifers in the Powder River Basin study area.

Surficial aquifers within the planning area consist of Quaternary and Tertiary alluvium, Tertiary fluvial sand and gravel deposits, and Tertiary terrace deposits. These surficial aquifers are located within the floodplains and along the channels of larger streams, tributaries, and rivers, and are among the most productive sources of groundwater within the planning area. The quality of groundwater from surficial aquifers is generally good, but within the Powder River RMP area and Blaine County it can be highly variable (approximately 1,500 mg/l to 2,800 mg/l total dissolved solids (TDS) and 5.0 to 10 SAR). The quality of groundwater from surficial aquifers within the west half of the Billings RMP area, as well as in Park and Gallatin counties, is usually very good. Wells completed in coarse sand and gravel alluvial aquifers can yield as much as 100 gallons per minute (gpm), although yields of 15 gpm are the average. Alluvial deposits associated with old river beds as detached terraces will usually only yield as much as 20 gpm because they are isolated topographically and have limited saturation (Zelt et al. 1999).

The occurrence of specific bedrock aquifers and the quality of groundwater produced from these aquifers vary throughout the planning area. In general, the quality of groundwater produced from bedrock aquifers is best near their recharge or outcrop areas. Groundwater produced near an aquifer's recharge zone has only been in contact with the rocks and minerals in the aquifer material for a relatively short period of time. As a result, the water has not had time to dissolve substantial amounts of soluble salts and minerals and so it remains fresh. The longer the water is in the aquifer, the more time it has to dissolve salts and minerals. In general, the concentration of total dissolved solids increases with distance from an aquifer's recharge or outcrop zone.

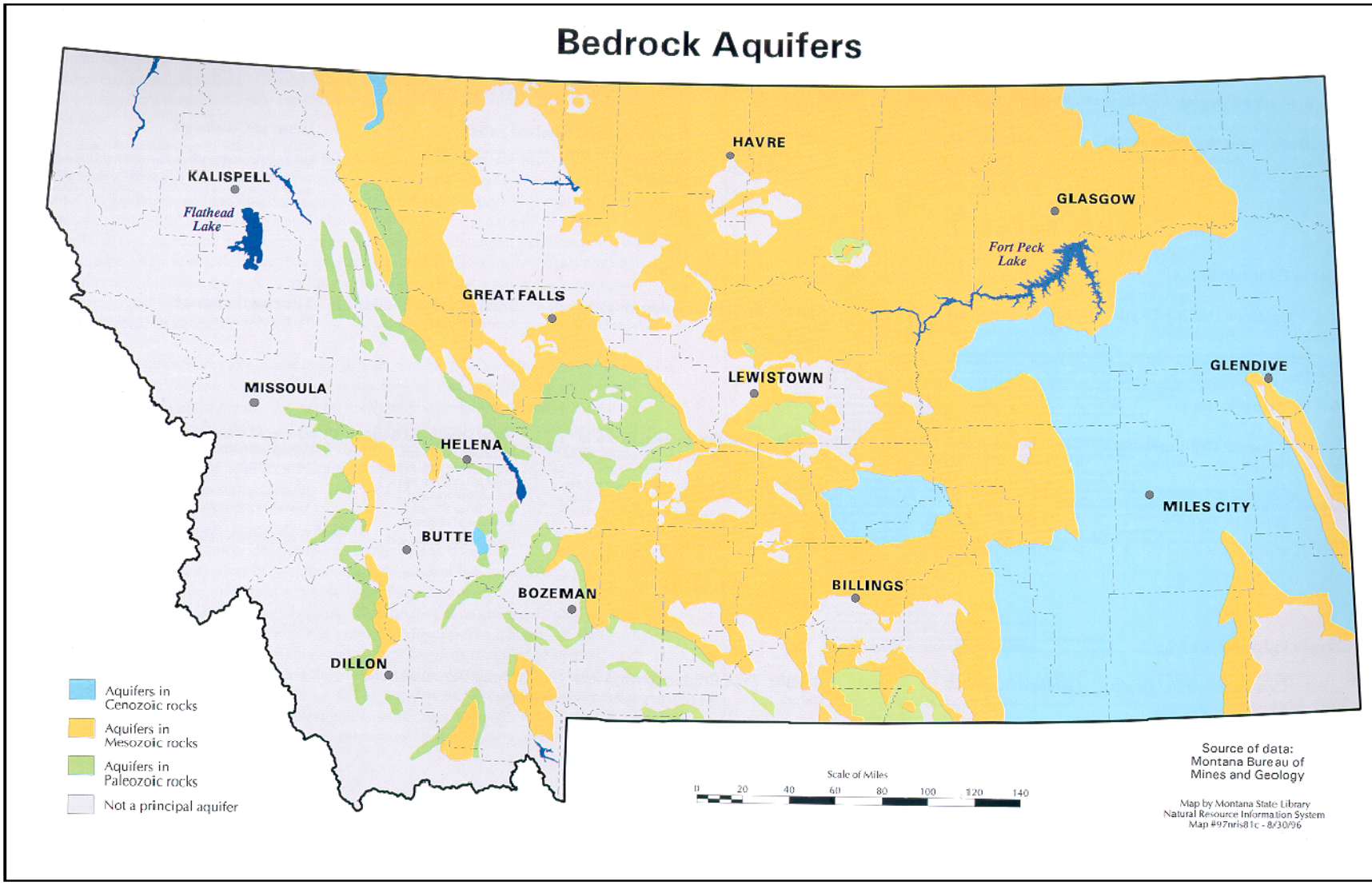
The sands and coals of the Fort Union Formation are important aquifers in the Powder River and Billings RMP areas. Groundwater within the Fort Union Formation has been shown to evolve in a predicable manner along its flow path (Van Voast and Reiten, 1988). In general the salinity of the water increases with time and depth as the water, in contact with geologic material, moves through the aquifer. Cation exchange is one of the normal processes that increases salinity, where calcium and magnesium are replaced by sodium, as the groundwater comes into contact with sodium rich shale. However, in deep portions of the aquifers, sulfate is removed by reduction reactions. This reduction causes the salinity of the water to decrease while increasing the ratio of sodium to calcium and magnesium. The result is a moderately saline (EC of ~1,800 to 2,500 mS/cm) sodium-bicarbonate rich water in the coal seam aquifers where coalbed methane is expected to be produced. Wells within the Fort Union Formation may produce as much as 40 gpm, but yields of 15 gpm are more typical. Where confined and artesian conditions exist, wells in the Fort Union Formation will generally flow at less than 10 gpm.

The Lower Hell Creek-Fox Hills aquifer is an important aquifer in the Powder River and Billings RMP areas. The quality of the water derived from the Lower Hell Creek-Fox Hills aquifer is generally good, with TDS levels ranging from 500 to 1800 mg/L. Groundwater yields from this aquifer may be as much as 200 gpm, but 70 gpm is more common. Artesian wells within the Lower Hell Creek-Fox Hills aquifer may yield up to 20 gpm.

The Judith River, Eagle, Kootenai, Ellis, and Madison aquifers are locally important, and details of their hydrologic properties and water quality are listed in Table 3-7.

Of particular importance is the water quality of groundwater within the primary aquifers of the area of main CBM potential; it is these aquifers that may be impacted by CBM development. Table 3-8 listed two of the more important aspects of water quality – TDS and SAR. Further details of water quality are discussed in the Water Resources Technical Report (ALL, 2001b) and in the Surface Water Quality Technical Report (Graystone and ALL, 2002).

Map 3-9


Bedrock Aquifers
HAVRE
KALISPELL
Flathead Lake
GLASGOW
Fort Peck Lake
GREAT FALLS
GLENDIVE
LEWISTOWN
MISSOULA
HELENA
MILES CITY
BUTTE
BILLINGS
BOZEMAN
DILLON
Aquifers in Cenozoic rocks
Aquifers in Mesozoic rocks
Aquifers in Paleozoic rocks
Not a principal aquifer
Scale of Miles
0 20 40 60 80 100 120 140
Source of data: Montana Bureau of Mines and Geology
Map by Montana State Library Natural Resource Information System
Map #97nris81c - 8/30/96

Map 3-10

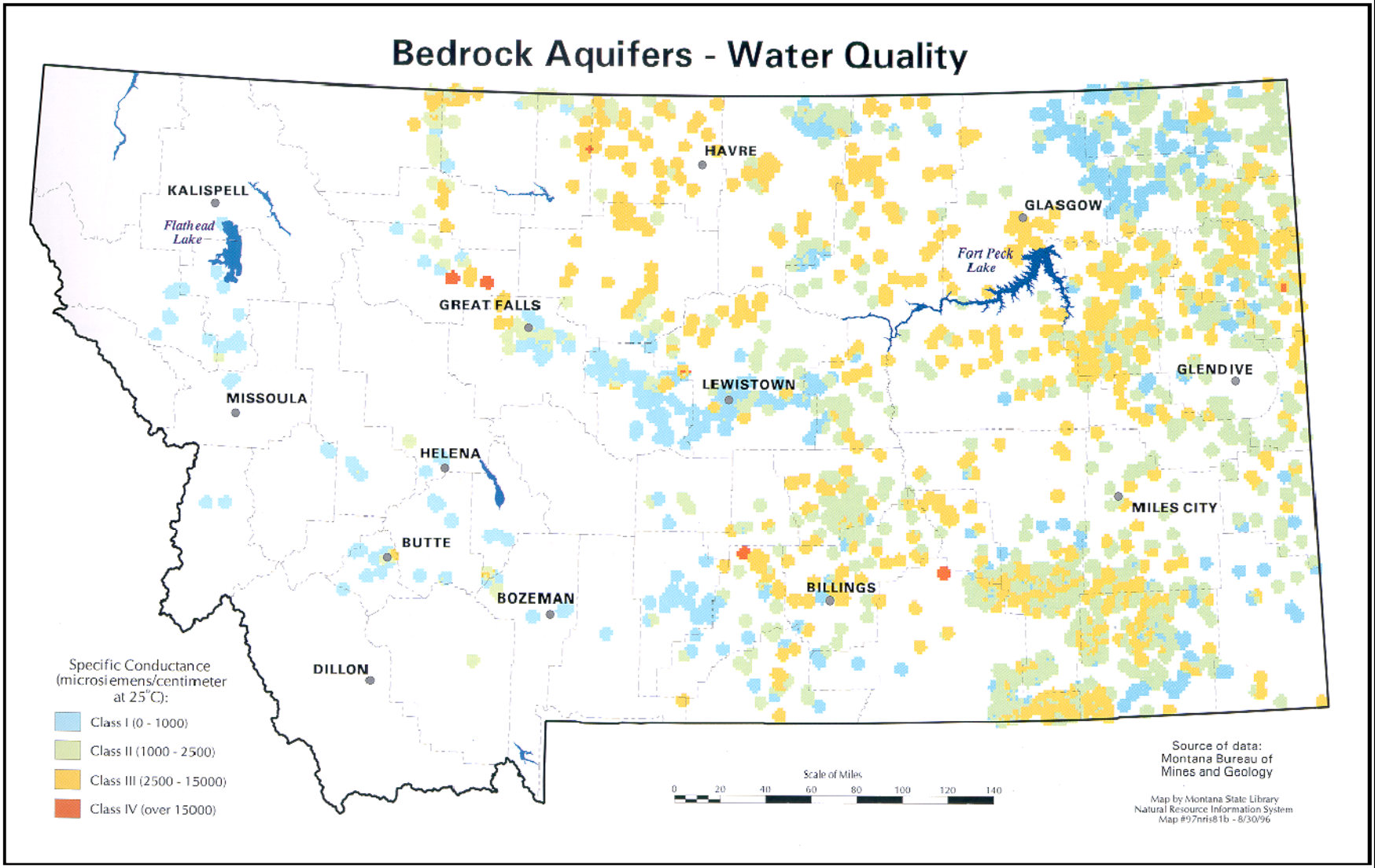

Bedrock Aquifers - Water Quality
HAVRE
KALISPELL
Flathead Lake
GLASGOW
Fort Peck Lake
GREAT FALLS
GLENDIVE
LEWISTOWN
MISSOULA
HELENA
MILES CITY
BUTTE
BILLINGS
BOZEMAN
DILLON
Specific Conductance (microsiemens/centimeter at 25°C):
Class I (0 - 1000)
Class II (1000 - 2500)
Class III (2500 - 15000)
Class IV (over 15000)
Scale of Miles
0 20 40 60 80 100 120 140
Source of data: Montana Bureau of Mines and Geology
Map by Montana State Library Natural Resource Information System
Map #97nris81b - 8/30/96

TABLE 3-7
PLANNING AREA AQUIFERS AND THEIR GENERAL CHARACTERISTICS

AQUIFERS IN SURFICIAL DEPOSITS						
Aquifer	**Common Drilling Depth**	**Geologic Materials**	**Aquifer Type**	**Production or Yield**	**Total Dissolved Solids**	**General Comments**
Alluvium, Fluvial-Glacial Gravels, Terrace Gravels, and Flaxville Formation Gravels and equivalents.	20 to 40 ft. May exceed 250 ft.	Unconsolidated clay, silt, sand, and gravel.	Commonly unconfined	Typically 5 to 50 gpm.	Range 300 to 2,200 milligrams/liter (mg/l).	Widely used aquifer systems. Alluvial aquifers are most often used because they lie near the surface and are accessible via shallow wells and water yield is routinely quite good. They can be partially confined to completely confined with yields that may exceed 1,500 gpm in some areas. Yields from gravel deposits are more variable but water quality is usually quite good. Alluvial aquifers are vulnerable to human-caused contamination in a variety of settings.
AQUIFERS IN CENOZOIC ROCKS						
Aquifer	**Common Drilling Depth**	**Geologic Materials**	**Aquifer Type**	**Production or Yield**	**Total Dissolved Solids**	**General Comments**
Fort Union Formation	50 to 300 ft. May exceed 1,000 ft.	Interbedded shale, siltstone, sandstone, and coal.	Commonly confined, except near surface.	Typically 5 to 50 gpm.	Range 500 to 5,000 mg/l.	The Fort Union is a major source of groundwater for eastern Montana. Water is suitable for watering stock but may not be suitable for irrigation.

TABLE 3-7
PLANNING AREA AQUIFERS AND THEIR GENERAL CHARACTERISTICS

AQUIFERS IN MESOZOIC ROCKS

Aquifer	Common Drilling Depth	Geologic Materials	Aquifer Type	Production or Yield	Total Dissolved Solids	General Comments
Lower Hell Creek-Fox Hills Formations	150 to 500 ft. May exceed 1,000 ft.	Mainly sandstone with some siltstone and shale.	Confined	5 to 20 gpm. May exceed 200 gpm.	Range 500 to 1,800 mg/l.	Although the Fort Union overlies the Hell Creek-Fox Hills, the latter is often the target for water well drilling as a result of its higher quality of water.
Judith River Formation	200 to 600 ft. May exceed 1,000 ft.	Sandstone, siltstone, with some coal.	Confined	5 to 15 gpm. May exceed 100 gpm.	Range 160 to 27,000 mg/l.	
Eagle Formation	100 to 800 ft. May exceed 2,000 ft.	Interbedded sandstone and shale.	Confined	10 to 20 gpm. May exceed 200 gpm.	Range 800 to 1,500 mg/l.	Water quality is best in central Montana, poorer in eastern Montana.
Kootenai Formation	100 to 1,000 ft. May exceed 3,000 ft.	Interbedded sandstone, siltstone, and shale.	Confined	10 to 30 gpm. May exceed 100 gpm.	Range 200 to 500 mg/l. May exceed 14,000 mg/l.	Used heavily near the Belt Mountains where water quality is good.
Ellis Group	300 to 2,000 ft. May exceed 5000 ft.	Sandstone, shale, limestone, and dolomite.	Confined	No Data.	Generally less than 600 mg/l.	Water quality is best near outcrop areas.

AQUIFERS IN PALEOZOIC ROCKS

Aquifer	Common Drilling Depth	Geologic Materials	Aquifer Type	Production or Yield	Total Dissolved Solids	General Comments
Madison Group	500 to 3,000 ft. May exceed 7,000 ft.	Limestone, dolomite, anhydrite, and halite.	Confined	20 to 6,000 gpm. Higher in karst areas.	Range 500 to 300,000 mg/l.	Very extensive aquifer, it underlies a large portion of the Great Plains. Water quality can be very high near recharge areas and is poorest in northeastern Montana.

FIGURE 3-5

ERA	Period	Principal Aquifers	Age:
CENOZOIC	Quaternary	Alluvium and Fluvial-Glacial Gravels	**10,000 Years**
	Tertiary	Alluvium Fluvial-Glacial Gravels (and equivalents) Terraces Fort Union Formation	**1.6 MYBP**
MESOZOIC	Cretaceous	Lower Hell Creek-Fox Hills Formation Judith River Formation Eagle Formation	**66.4 MYBP**
	Jurassic	Kootenai Formation Ellis Group	
	Triassic	No Principal Aquifers	**245 MYBP**
PALEOZOIC	Permian	No Principal Aquifers	
	Pennsylvanian Mississippian	No Principal Aquifers Madison Group	
	Devorian Silurian Ordovician Cambrian	No Principal Aquifers	**570 MYBP**

MYBP – Millions of Years Before Present

TABLE 3-8
GROUNDWATER QUALITY FOR THE MONTANA PORTION OF THE POWDER RIVER BASIN
SELECTED GROUNDWATER QUALITY DATA COLLECTED FROM WATER SUPPLY WELLS LOCATED THROUGHOUT MONTANA POWDER RIVER BASIN

	Judith River Formation		Hell Creek /Fox Hills Formation		Fort Union Formation		Quaternary Alluvium	
County	Avg. TDS (mg/l)	Avg. SAR	Avg. TDS (mg/l)	Avg. SAR	Avg. TDS (mg/l)	Avg. SAR	Avg. TDS (mg/l)	Avg. SAR
Big Horn	936	54	1,440	14	1,658	8	2,118	5
Rosebud	2,465	31	1,376	35	1,595	16	1,516	9
Powder River	No data	No data	890	35	1,882	15	2,783	5
Custer	No data	No data	896	37	1,810	31	1,665	8
Treasure	2,312	64	1,985	56	1,782	32	2,437	10
Weighted Average	2,100	42	1,148	37	1,892	18	2,014	7

Note:
Avg. TDS = Average Total Dissolved Solids
Avg. SAR = Average Sodium Adsorption Ratio
Source: MBMG 2001

Water Rights

Water rights in Montana are the subject of The Montana Water Use Act (Title 85, Chapter 2, MCA) of 1973, which became effective July 1, 1973. Water rights existing prior to that date are to be finalized by state courts. Water rights applications since that date are secured through a MDNRC permit system. In addition, some water rights are protected under federal and state statutes.

Water rights on some BLM lands are protected by the Federally Reserved Water Rights for Public Springs and Water Holes, Public Water Reserve 107, pursuant to Executive Order dated April 17, 1926. Compacts between the State of Montana and Northern Cheyenne Tribe have placed moratoria on new water use developments on Tribal Lands within the Rosebud, Lower Bighorn, and Pryor watersheds. Native American water rights are discussed in detail in the Indian Trust Assets section of this chapter.

Water rights are being adjudicated on a watershed basis. The Tongue River and Little Bighorn have not yet been fully adjudicated, Rosebud is 78 percent examined prior to being adjudicated, Lower Yellowstone is 90 percent examined. Table 3-9 lists water rights developments by watershed in the area of main potential for CBM production. Native American Water Rights are discussed in detail in the Indian Trust Assets section of this chapter.

The Montana Water Use Act (85-2-506) established the designation of the Powder River Basin Controlled Groundwater Area. The MDNR established in the Controlled Groundwater Area in anticipation of the withdrawal of groundwater associated with CBM development. Two issues relating to water rights were addressed as part of the order. First, CBM operators must offer water mitigation agreements to owners of water wells and natural springs within 1/2 mile of a CBM field proposed for approval by the MBOGC or within the area that the operator reasonably believes may be impacted by a CBM production operation, whichever is greater. Second, beneficial uses of CBM-produced water require water rights issued by MDNRC as established by law.

TABLE 3-9
WATER RIGHTS DEVELOPMENT SUMMARY BY WATERSHED

Watershed	Number of Pre-1973 Developments		Number of Post-1973 Developments		Number of Pending Water Rights Permits
	Surface	Ground-water	Surface	Ground-water	
Rosebud	765	408	27	210	1
Upper Tongue River	820	504	35	136	3
Lower Tongue River	2,407	2,278	98	662	1
Little Powder	1,320	741	66	166	3
Lower and Middle Powder and Mizpah	5,204	2,816	314	4	7
Lower Yellowstone	3,398	1,330	278	804	4
Little Bighorn	786	387	35	96	0
Lower Bighorn	1,522	596	105	419	3

DNRC 2001

Indian Trust Assets

The U.S. Department of the Interior (DOI) Departmental Manual 303 DM 2 defines Indian Trust Assets (ITAs) as lands, natural resources, money, or other assets held by the federal government in trust or that are restricted against alienation for Indian tribes and individual Indians. DOI Departmental Manual 512 DM 2 requires all of its bureaus and offices to explicitly address anticipated effects on ITAs in planning, decision, and operating documents.

Beyond the maintenance of tangible assets, the federal government also has a trust responsibility to be considerate of the general well being of the tribes. This responsibility includes recognizing the Indian culture as an important value and to carefully consider Indian cultural values when conducting planning efforts. Indian cultural values include their unique way of life, ceremonial practices, spiritual beliefs, family values, and worldview. The DOI Department Manual 512 DM 2 also asserts an affirmative responsibility to ensure the tribal health and safety, to consult on a government-to-government basis with tribes who may be affected by proposed actions, to disclose all applicable information and to fully incorporate tribal views in its decision-making processes.

Background

Lands associated with a reservation or public domain allotments are examples of ITAs. Natural resources that exist within Indian reservations such as standing timber, minerals, and oil and gas are ITAs. Treaty rights, water rights, and hunting and fishing rights may also be ITAs. Other ITAs may consist of financial assets held in trust accounts or intangible items such as Indian cultural values, ITAs are a product of the unique history and relationship of the U.S. government with various American Indian tribes. There is no similar relationship between the Montana State government agencies and sovereign dependent Indian tribal nations (like the Northern Cheyenne and Crow Tribes). See Map 1-1 for the general location and boundaries of the reservations, and Table 3-10 for ITA acreages.

Identification Methods

The BIA is required to develop inventories of ITAs for all Indian tribes. The only ITAs in the EIS emphasis area are the actual Indian reservation lands, natural resources and rights belonging to the Assiniboine, Northern Cheyenne, Crow, Gros Ventre, and the Turtle Mountain tribes.

Applicable Laws

Federal

The DOI Department Manual 512 DM 2 requires all DOI Bureaus and offices to explicitly address anticipated effects on ITAs in planning, decision, and operating documents. This order also requires descriptions of how decisions will conform to the DOI's trust responsibilities. Furthermore, DOI Department Manual 303 DM 2 outlines the principals for managing ITAs.

TABLE 3-10
INDIAN TRUST ASSETS

Tribe	Acreage of Reservation	Trust Acres	Tribal Surface Acres	Individually Allotted Surface Acres	Tribal Mineral Acres	Individually Allotted Mineral Acres	Fee Acreage
The Northern Cheyenne	445,000	442,193	444,000	138,211	444,000	138,211	2,087
The Crow	2,296,000	1,491,569	455,719	1,035,850	405,888	824,427	804,431
Fort Belknap Community Council	623,000	618,228	232,799	385,429	54,351	369,044	4,772
Turtle Mountain Public Domain Allotments	N/A	61,520	N/A	61,520	N/A	61,520	N/A

Source: Madison 2001

State

ITAs are not considered under any State standards or regulations.

The Crow Tribe

The Crow Reservation is located in south-central Montana, and comprises nearly 2,296,000 acres. Access is via Interstate 90 or U.S. Highway 87. The reservation is bordered on the south by the State of Wyoming, on the east by the Northern Cheyenne Reservation, and on the northwest by the city of Billings, which is Montana's largest metropolitan area. The reservation encompasses the Little Big Horn Battlefield and approximately 3,600 square miles of rolling prairie and rugged foothills drained by the Bighorn River. The BIA Realty Office indicated that the tribe has some 455,719 surface acres and 405,888 acres of mineral rights. There are another 1,035,850 acres that have been individually allotted, and 824,427 acres of allotted mineral rights.

There are about 10,083 Crow tribal members, the majority of which live on the reservation. The Crow language is spoken by more than 80 percent of the tribe. Headquarters are at Crow Agency, Montana, just south of Hardin, Montana. The total labor force on the Crow Reservation is 3,902. The unemployment rate is 61 percent. The average per capita income is $4,243.

Water Rights

The Crow have existing water rights held in trust, similar to the Northern Cheyenne. The Crow Tribe has not negotiated a water rights compact with the State of Montana.

Mineral Rights

The BIA Realty Office has stated that the Crow have mineral right assets totaling some 405,888 subsurface acres and another 824,427 allotted mineral acres.

Cultural Resources

The Crow also considers cultural and prehistoric resources located within their reservation to be ITAs. At present, an unknown number of archaeological resources are on the reservation. Sites are known to exist on the reservation, but the tribe reserves the information. These sites can consist of burials, trails, rock features, lithic scatters, house pits/rings, rock-shelters, caves, bison kills, and petroglyphs.

The Northern Cheyenne Tribe

The Northern Cheyenne Indian Reservation occupies about 445,000 acres in eastern Big Horn and southern Rosebud counties, Montana. Access is provided by U.S. Highway 212. The reservation covers nearly 695 square miles and is bordered on the east by the Tongue River and on the west by the Crow Reservation. According to the BIA Realty Office, the tribe has 442,193 trust acres and 444,000 of surface and mineral estate lands. There are 138,211 individual allotted acres on the reservation.

The total tribal population is 7,473, of which approximately 4,212 Northern Cheyenne live on or near the reservation. The tribal headquarters are in the town of Lame Deer. The total work force of the tribe is approximately 2,437 and the unemployment rate is 71 percent according to the BIA Indian Labor Force Report (BIA 1999). The per capita income is estimated at $4,479.

Water Rights

The Northern Cheyenne Tribe has existing water rights held in trust by the U.S. The 1908 U.S. Supreme Court ruling in *Winters v. U.S.* (207 US 564) ruled that water rights needed to develop Indian reservations were reserved, and this includes both groundwater and surface water rights.

The Northern Cheyenne have a water rights compact with the State of Montana and own a significant amount of water in the Tongue River Basin, including a principal portion of the Tongue River Reservoir.

The Northern Cheyenne Tribe has developed draft water quality standards and is currently discussing an agreement with the State of Montana and the BLM regarding preservation of beneficial uses. The draft water quality standards have not been submitted to the EPA for approval

Mineral Rights

The Indian Minerals Development Act (PL 97-382, 25 USC 2101) and the Federal Oil and Gas Royalty Management Act of 1982 (PL 97-451) provide that information about mineral development of Indian Trust lands are proprietary to the individual tribe and may not be disclosed without consent. The BIA Realty Office has stated that the Northern Cheyenne have mineral right assets totaling some 444,000 subsurface acres.

Cultural Resources

The Northern Cheyenne Tribe considers cultural resources located within their reservation to be ITAs. Sites are known to exist on the reservation, but the information is reserved by the tribe. These sites can consist of burials, trails, rock features, lithic scatters, house pits/rings, rock-shelters, caves, bison kills, and petroglyphs.

Fort Belknap Community

The Fort Belknap Indian Reservation is positioned in north-central Montana near the Canadian border between the Milk River and the Little Rocky Mountains. The reservation is in Blaine and Phillips counties. The trust acreage of the reservation is roughly 618,228 acres (Madison 2001). The land is predominately rolling prairie with good grass and brush cover. There are 232,799 tribal-owned surface acres and an additional 385,429 individually allotted surface acres. The mineral rights include 54,351 tribal acres and 369,044 allotted acres.

The reservation houses two tribes that operate under one central government. The two tribes are the Gros Ventre and the Assiniboine. The combined enrollment of the two tribes is approximately 5,133 (Fort Belknap Indian Community 2001). The tribal headquarters are located at the Fort Belknap Agency, 3 miles southeast of Harlem, Montana, on U.S. Highway 2. The total labor force on the Fort Belknap Reservation is 721 and the per capita income is $4,536. The unemployment rate is 29.5 percent.

The tribes' economy is based on agriculture, which includes farming, ranching, and land leasing, including grazing permits. Crops include wheat, hay, and barley. The reservation's climate, as with most of north-central Montana, is subject to severe weather extremes, with hot, dry summers and harsh winters. Both fishing and hunting are popular, and trout, deer, antelope, and some migratory waterfowl are plentiful.

Water Rights

Fort Belknap Reservation is where the 1908 U.S. Supreme Court decision in *Winters v. U.S.* (207 US 564) was originally contested regarding Indian water rights. As noted previously, the waters are a federally reserved trust asset.

Mineral Rights

The BIA Realty Office has stated that the Assiniboine and Gros Ventre have mineral right assets totaling about 54,351 subsurface acres and another 369,044 allotted mineral acres.

Cultural Resources

The Assiniboine and Gros Ventre consider cultural and prehistoric resources located within their reservation to be ITAs. The number of archaeological resources on the reservation is unknown. The tribes reserve information about cultural sites. These sites can consist of burials, trails, rock features, lithic scatters, house pits/rings, rock-shelters, caves, bison kills, and petroglyphs.

The Turtle Mountain Public Domain Allotments

There are approximately 61,520 acres (Madison 2001) of trust lands allotted to the members of the North Dakota Turtle Mountain Tribe scattered throughout 2,000 square miles of Montana.

In 1906, the Burke Act provided that individual tribe members could receive allotments of reservation land. At that time, parcels of 160 acres each were allotted to individuals of the Turtle Mountain Tribe in Montana. These allotments, although not grouped as a reservation, are within the planning area. These Trust lands are subject to the same leasing and development procedures as for the reservations.

Lands and Realty

A variety of land uses exist throughout the planning area, including agricultural (crops and grazing); roads and highways; railroads; utility rights-of-way (ROW) for electrical power lines and telephone; communication sites; oil and gas production and pipelines; residential; commercial and light industrial uses; mining; municipalities; and recreation.

Table 3-11, *Land Ownership*, shows surface ownership in acres by county for federal, state, tribal, and private lands. It also shows that approximately 65 percent of the land is private land. The majority of the private land is agriculturally based (grazing and crops). The next largest ownership is federal lands at 20 percent. Federal lands include lands managed by the BLM, U.S. Forest Service (USFS), National Park Service, U.S. Bureau of Reclamation (USBR), and U.S. Fish and Wildlife Service (FWS). BLM and USFS lands are used for grazing, timber production, mineral production (except for the Custer National forest, which is excluded from surface coal mining by Section 522 of the SMCA of 1977), and year-round recreation activities; USBR lands are used for water storage and recreation; National Park Service lands are used for recreation; and FWS lands are used for wildlife refuges and recreation.

Tribal lands comprise 10 percent of the land in the planning area. They are used for cattle production, mining, logging and lumber production, residential, and recreation on the Northern Cheyenne Reservation. Major land uses on the Crow Reservation include agriculture, mining, and recreation (Madison 2001).

State lands comprise the least amount of land in the planning area at 5 percent. This land is used for grazing, mining, timber production, oil and gas production, state parks, and recreation activities. State lands are composed of school trust land administered by DNRC Trust Land Management Division, land owned by DNRC Water Resources Division, and land owned by other state agencies. Uses vary by agency. School trust land uses include agriculture, grazing, mineral exploration and mining, aggregate production, recreational activities, oil and gas exploration and production, timber production, and special uses, for example, wind turbines for energy production. School trust lands also have pipelines, power lines, telephone lines, roads and highways, home site leases, and cabin site leases, depending on the situation.

Roads and highways include interstate, U.S., state, and off-system roads open to the public—county, local, and private roads open to public use. Table 3-12 lists the number of miles of each type within the planning area.

Railroad ROW crisscross the counties in the planning area. Railroads in the planning area transport goods such as grains, intermodal containers, and coal. Table 3-13 indicates the approximate miles of railroad ROW within the planning area for each county, by railroad.

There are existing gas pipelines in all the counties being studied. Some existing roads, utilities, and gas lines could be used as part of the network for new CBM installations.

TABLE 3-11
LAND OWNERSHIP

		Federal					Managed by State			Managed by Tribal			
County	Total Acres	BLM	Forest Service	National Park Service	Bureau of Reclamation	U.S. Fish & Wildlife Service	Lands	Water	State Park	Federal Government Holdings	Tribal Land	Private	Unknown
Big Horn	3,208,115	61,617	12	762			97,483	16,535	3,733	1,996	1,565,898	1,459,556	523
Blaine	2,711,111	465,021		204		2,700	173,811	12,138		19	498,968	1,558,250	
Carbon	1,319,367	222,309	323,729		6		42,463	9,099	382		121	700,233	21,025
Carter	2,132,128	505,614	90,246				141,754	5,736	372			1,388,406	
Custer*	1,556,352	188,226	46,332				89,787	3,245				1,228,762	
Gallatin	1,682,769	9,026	607,719	62,927			52,793	16,549	7,825			925,930	
Golden Valley	752,094	8,182	23,570			303	48,898	1,523				669,618	
Musselshell	1,196,032	102,932				13,586	75,742	3,642				1,000,130	
Park	1,799,785	13,459	752,830	93,555		1,113	33,172	6,587				899,069	
Powder River	2,109,880	258,817	340,424				141,034	560				1,369,045	
Rosebud*	1,502,305	83,857	95,575				64,807	3,031			242,132	1,012,903	
Stillwater	1,154,243	5,986	191,973		12	3,800	45,600	11,531				895,341	
Sweetgrass	1,190,833	16,116	281,586				47,836	4,502	135			840,658	
Treasure	629,224	12,252	1,323				36,955	3,635			1,600	573,459	
Wheatland	913,079	1,415	65,397				74,379	3,446	1,329			767,113	
Yellowstone	1,693,991	86,924			1,487	284	80,042	9,034	41		134,010	1,382,169	
Total:	25,551,308	2,041,753	2,820,716	157,448	1,505	21,786	1,246,556	110,793	13,817	2,015	2,442,729	16,670,642	21,548

Data Sources: Land Ownership, Highways and Railroad ROW, Montana State Library/NRIS, Helena, Montana. Created from GIS intersection of 1:100,000 scale county boundaries with 1:100,000 scale Land Ownership, Highways, and Railroad ROW.

*Acreage reflects only that portion of this county included in the planning area.

TABLE 3-12
MILES OF ROAD/HIGHWAY

County	Interstate	U.S.	State	Off-System
Big Horn	81.8	38.7	21.7	925.0
Blaine		54.5	39.3	1,359.0
Carbon		107.6	46.0	833.0
Carter		38.3	12.1	694.0
Custer	42.8	25.5	51.8	824.0
Gallatin	43.6	115.0	67.2	1,441.0
Golden Valley		29.2	12.4	483.0
Musselshell		99.5	1.6	554.0
Park	32.4	104.0	6.7	781.0
Powder River		64.6	55.1	718.0
Rosebud	41.9	26.2	51.3	1,052.0
Stillwater	38.1		23.0	858.0
Sweetgrass	37.1	31.8		516.0
Treasure	26.2			244.0
Wheatland		79.8		449.0
Yellowstone	95.2	29.8	41.7	1,826.0
Total	**439.1**	**844.4**	**430.0**	**13,557.0**

Data Sources: Land Ownership, Highways and Railroad ROW, Montana State Library/NRIS, Helena, Montana, 2001. Created from GIS intersection of 1:100,000 scale county boundaries with 1:100,000 scale Land Ownership, Highways, and Railroad ROW.

TABLE 3-13
MILES OF RAILROAD ROW

County	Railroad		
	BNSF[1]	**Montana Rail Link**	**Tongue River Railroad (Proposed)**
Big Horn	119		19
Blaine	62		
Carbon	61		
Custer	32		44
Gallatin		72	
Golden Valley	70		
Musselshell Park		34	
Rosebud	39		64
Sweetgrass		32	
Treasure	36		
Yellowstone	32	50	
Totals	419	188	127 (proposed)

Data Sources: Land Ownership, Highways and Railroad ROW, Montana State Library/NRIS, Helena, Montana. Created from GIS intersection of 1:100,000 scale county boundaries with 1:100,000 scale Land Ownership, Highways, and Railroad ROW.
[1]BNSF—Burlington, Northern, and Santa Fe Railroad.

Livestock Grazing

Most grazing allotments involve only one permittee; however, there are several multi-permittee allotments. There are no other rights or control of public lands granted by issuance of a grazing permit. The length of grazing periods varies from seasonal to year-long use. Most ranch operators using the allotments are cow-calf operations with sheep operations coming in second.. Most allotments have several range improvements such as fences, stock ponds, pipelines, springs, windmills, seedings, wells, and access roads for better control of livestock for management purposes (BLM 1992).

In the planning area, approximately 1,205 allotments cover 1.6 million acres of federal lands (Tribby 2001, Padden 2001, Haas 2001).

These allotments are used to graze cattle, sheep, and horses. The main class of livestock using public lands is cattle (93 percent). Authorized livestock use on the grazing allotments totals about 288,000 animal unit months, which include active-use, non-use, and exchange-of-use options (Tribby 2001, Padden 2001, Haas 2001). An animal unit month is the amount of forage necessary to support one cow and her calf, or five sheep, for one month.

The TLMD regulates the grazing rights for the trust land resources in the State. For the RMP areas and three additional counties, there is a total of 1,207,400 acres of classified grazing and forested lands, and 323,941 animal unit months. Grazing use of trust lands for the entire state includes approximately 8,500 agreements during the year 2000. The 4.3 million acres of classified grazing and forested lands have an estimated carrying capacity of 1,090,000 animal unit months (Chappell 2001).

Native Americans

There are seven federally recognized Indian tribal organizations in Montana. They are the Assiniboine and Sioux Tribes of Fort Peck (Sioux Division of Sisseton/Wahpetons, the Yantonias, the Teton Hunkpapa, and the Assiniboine bands of Canoe Paddler and Red Bottoms), the Blackfeet Tribe, the Chippewa Cree Tribe, the Confederated Salish and Kootenai, the Crow Tribe of Montana, the Fort Belknap Indian Community (the Assiniboine and the Gros Ventre), and the Northern Cheyenne Tribe. Non-federally recognized tribes also reside in Montana: the Little Shell Band of Chippewas of Montana and the Metis.

Tribal enrollment within these organizations is recorded as 61,203 individuals or nearly 6.6 percent of the state's population. Within this population there is an average unemployment rate of 61 percent and a high level of poverty (BIA 1999).

The majority of these native people reside on seven Indian reservations throughout Montana. The reservations are the Crow, Northern Cheyenne, Fort Peck, Fort Belknap, Rocky Boys, Blackfeet, and the Flathead. Three reservations are within the planning areas of the State of Montana and the BLM: the Crow, Northern Cheyenne, and Fort Belknap. Of particular interest are the Crow and Northern Cheyenne reservations that are located within the CBM emphasis area of the Powder River Basin.

The Crow Indian Reservation

Much of the information in this section has been summarized from the Crow Indian Reservation's *Natural, Socio-Economic and Cultural Resources Assessment and Conditions Report* (Crow Tribe 2002). Readers should refer to that document for more detailed information. This document can be downloaded from the MDEQ CBM web page at http://www.deq.state.mt.us/CoalBedMethane/index.asp

The Crow Reservation is located in south-central Montana, and comprises nearly 2,296,000 acres. Access is via Interstate 90 or U.S. Highway 87. The reservation is bordered on the south by the State of Wyoming, on the east by the Northern Cheyenne Reservation, and on the northwest by the city of Billings, which is Montana's largest metropolitan area. The reservation encompasses the Little Big Horn Battlefield and approximately 3,600 square miles of rolling prairie and rugged foothills drained by the Bighorn River. The BIA Realty Office indicated that the tribe has some 455,719 surface acres and 405,888 acres of mineral rights. There are another 1,035,850 acres that have been individually allotted, and 824,427 acres of allotted mineral rights.

Mountains, residual uplands, and alluvial bottoms make up the topography of the Crow Reservation. The three principle mountain areas are the Wolf Mountains (CHEETIISH) to the east and the Big Horn (BASAWAXAAWUUA) and Pryor Mountains (BAAHPUUO ISAWAXAAWUUA) to the south. Sloping downward to the north from the mountains are rolling upland plains. The plains constitute the bulk of the reservation and vary in altitude from 3,000 to 4,500 feet. The alluvial bottomlands are located along the Big Horn River, Little Big Horn River, and Pryor Creek drainage systems.

Reservation communities include Crow Agency, Saint Xavier, Yellowtail (Fort Smith), Lodge Grass, Wyola, and Pryor. The Crow Tribe recognizes six districts within the reservation. The six districts are Big Horn, Black Lodge, Lodge Grass, Pryor, Reno and Wyola. (Crow Tribe 2002).

Tribal Government

The U.S. signed treaties in 1825, 1851, and 1868 with the Crow Tribe. These legal documents define the tribes' relationship with the U.S., recognized their rights as a sovereign government, and established reservation boundaries. The U.S. first recognized the Crow Tribe by Treaty in 1825 (ratified August 4, 1825. 7 Stat. 266, proclaimed February 6, 1826), and this recognition has continued through today as evidenced by the Federal Register notice of July 12, 2002. The Treaty of 1851 established the Crow Reservation. The Tribal government has authority within the boundaries of the reservation for all ROW, waterways, watercourses, and streams, running through any part of the reservation.

The Crow Tribe of Indians repealed its 1948 constitution and By-Laws in July 2001. The Crow Constitution of 2001 established a three-branch government, Executive, Legislative, and Judicial. Each branch possesses separate and distinct power. Elected Executive and Legislative branch officials hold 4-year terms. Tribal judges, who serve for life, are selected by the Tribal Chairman and confirmed by a majority vote of the Legislature. Judgeships consist of a Chief and Associate Judges. Crow Tribal Law and Order Code direct the Tribal Court.

The Legislature consists of 18 representatives from six Legislative Districts (three representatives from each district) in the reservation. The Legislative Branch promulgates and adopts laws, resolutions, ordinances, codes, regulations, and guidelines in accordance with

the 2001 Constitution and federal laws. These legislative measures include taxes and licensing to protect and preserve property, wildlife, and natural resources.

The Executive Branch includes a Chairman, Vice-Chairman, Secretary, and Vice-Secretary. The Executive Branch is empowered to administer funds, and to enforce laws, ordinances, resolutions, regulations, or guidelines passed by the Legislative Branch.

Demographics

As of 2000, 69 percent of the 10,220 enrolled members of the Crow Tribe were living on the Crow Indian Reservation (reservation). The off-reservation population of enrolled members included 850 (8 percent) in Hardin, and 2,340 (23 percent) in other areas, primarily Big Horn County, Billings (Yellowstone County), and other Montana and Wyoming counties near the reservation. In the 2000 Census, the reservation's population was 6,890, an increase of 15 percent from 1980. Native Americans made up 75 percent of the reservation's population. Ninety-four percent of the reservation's population was in Big Horn County and the other 6 percent in Yellowstone County.

Between 1990 and 2000, the population of the Crow Indian Reservation increased by 520 (8 percent) compared to an 11.8 percent increase for all of Big Horn County. Average annual population growth has been less than 1 percent since 1980. The median age on the reservation is 27.6, compared to 37.5 for Montana as a whole. The population is distributed between the reservation communities of Crow Agency, Dunmore, Garryowen, Lodge Grass, Wyola, Pryor, Saint Xavier, and Yellowtail and rural areas outside of the communities.

In the 1990 Census, 41.7 percent of persons on the Crow Indian Reservation were living below the poverty level. Poverty status on the reservation as determined by the BIA for 1999 was 38 percent (see Table 3-14).

Social Organization

As of 2000, there were 2,280 housing units on the reservation. Of these, 1,320 (58 percent) were owner-occupied, 24 percent were rented-occupied, and 18 percent were vacant (presumably due to substandard conditions). Household size in 2002 was 3.5 for owner-occupied and 3.9 for renter-occupied. The reservation has a shortage of adequate housing for the needs of the population. The Crow Tribal Housing Authority identified 250 homes with more than one family in the households in 2002 and a waiting list of 300 families in need of housing. In 1997, the BIA identified a need for 1,040 new housing units on the reservation and 890 families in need of housing. Temporary housing off the reservation is available in Hardin, just north of the reservation in Montana, and in Sheridan, Wyoming, about 25 miles south of the reservation.

The Crow Indian Reservation Natural, Socio-Economic and Cultural Resources Assessment and Conditions Report describes in detail the public facilities and services in five of the larger communities on the Crow reservation. Telephone, gas, and electric utilities are provided by a variety of county and other utility companies. Educational facilities include elementary, junior high, and high schools and Little Big Horn Community College. Varying levels of public water and sewer systems are provided, depending on the community. Some of these systems are in need of maintenance and repair. The communities also have varying levels of medical, police, and fire protection services.

The reservation has eight elementary schools, three high schools, and the Little Big Horn Community College. The three high schools are located in Lodge Grass, Pryor, and Hardin. From coal mining revenues, the schools at Hardin and Lodge Grass have become two of the wealthiest in the state. Public schools are also available in both Billings and Hardin. Approximately 70 percent of members have a high school diploma and more than 6 percent have a Bachelor's Degree or higher.

Economics

The most recent employment information for the reservation is from the 1990 Census. In 1990, total employment on the reservation was 1,660. The tribal and federal governments are the largest employers. The Crow tribal government employed 400 persons in 2002. Agriculture (330, 20 percent), education (240, 15 percent), and retail trade (230, 14 percent) were the largest industry sectors. Private wage and salary (780, 47 percent) and government (590, 36 percent) were the largest classes of employment. According to the 1990 Census, the reservation's labor force (persons 16 years and older) was 2,380, with an unemployment rate of 30.4 percent. Much higher rates (61 percent) are reported by BIA statistics from 1999 (see Table 3-15).

TABLE 3-14
TRIBAL POVERTY RATES AMONG THOSE EMPLOYED (1999)

Tribe	County	Total Tribal Enrollment	Percent Employed but Below Poverty Guideline
Crow Tribe of Montana	Big Horn County, Yellowstone County	10,083	38%
Northern Cheyenne Tribe	Big Horn County, Rosebud County	7,473	26%
Fort Belknap Indian Community	Blaine County	5,223	40%
Montana (all tribes)		61,203	33%

Source: BIA 1999.

TABLE 3-15
AVERAGE ANNUAL UNEMPLOYMENT RATES BY RESERVATION

	1996 Rate (%)	1999 Rate (%)	Change 1996-1999
Crow Reservation	15.5	14.9	0.6
Northern Cheyenne Reservation	26.0	18.7	7.3
Fort Belknap Reservation	27.2	22.9	4.3

Source: Montana Department of Labor & Industry, Research & Analysis Bureau, Local Area Unemployment Statistics (2001a)

Page 3-38 of the Statewide Draft Oil and Gas EIS states that tribal members' 1999 per capita income was $4,243. By comparison, per capita income for Big Horn County was $13,329 and the State of Montana was $21,229. In the 1990 Census, median household income for the reservation was $17,270, compared with $19,900 for Big Horn County and $22,988 for the state.

Agriculture has been the historic base of the reservation economy. Agricultural crops include livestock, wheat, barley, oats, corn, sugar beets, alfalfa, and hay. In 2000, the Montana State University/Big Horn County Agricultural Extension Service estimated the values of crops and livestock on the reservation were $20.9 and $35.5 million, respectively.

Natural resources (land, water, coal, oil and gas, timber, and sand and gravel) also contribute to the employment base and income on the reservation. The Absaloka Mine is located within 5 miles of the reservation's northern boundary and employs between 40 and 75 Crow tribal members. The Stateside Draft Oil and Gas EIS (p. 3-40) states there have been 172 conventional oil and gas wells drilled on the reservation. These wells have been drilled by non-Indian interests through leases with the Crow Tribe. In 1985, 20 companies had 709 oil and gas leases with the Crow Tribe. The reservation has about 36,000 acres of commercial forest in the Wolf and Pryor mountains; timber units are generally leased to non-Indian interests for harvesting.

The Crow Tribe receives government revenue from its natural resources through numerous land leases, boundary settlement allotments, and income-producing trusts generated through coal, mineral, oil, gas, and timber reserves. The majority of these trusts are

administered by the U.S. Government's Office of Trust Fund Management.

The Crow Tribe's economic development plans incorporate the reservation's resources such as agriculture, energy, tourism and recreation, and commercial enterprises. The tribe is currently working with programs from federal agencies to prepare a strategy for comprehensive economic development. As part of the federal Economic Development Administration's community economic development strategy (CEDS), the tribe is preparing an economic development plan to balance development and protection of the reservation's resources.

Air Quality

The air quality and climate of the Crow Reservation is similar to that of the regions described earlier in Chapter 3. The Crow Reservation is classified as a PSD Class II area.

The reservation is located in a part of Montana that has a moderate climate relative to its latitude. Snow rarely accrues for long periods of time because of the warm Chinook winds, which originate from the mountains in the West. This portion of Montana is also known for its "Indian Summers" which frequently extend into November. The mean annual temperature is 45.5°F with a summer high of 110°F and a winter low of -48°F. The bulk of the reservation varies from 12 to 18 inches annual precipitation, depending on the elevation.

CBM development activities would need to meet the air emission standards set in the Crow Tribe's Law and Order Code, Section 11. These regulations limit particulate matter and sulfur dioxide emissions from combustion equipment, as well as set visible emissions limits. The tribe is currently in the process of developing and rewriting its codes and standards for air pollution.

Culture and History

The Crow Tribe's native name is the Apsalooke, literally translated, "children of the large beaked bird." Early explorers mistook the signing for Apsalooke, the flapping of one's hands like the wings of a bird in flight, and called them the Crow. The Crow were historically recognized as matrilineal and their social system was clan based. The original 13 clans of the Crow Tribe are as follows:

- Ashilaaliio—Newly Made Lodges
- Ashshitchite—Big (husky) Lodges
- Ashiiooshe—Sore (burnt) Lip Lodge
- Uuwuutashshe—Greasy Mouths
- Uussaawaachia—Brings Game Home Without Shooting
- Xuhkaalaxche—Ties Things Into a Bundle
- Ashpeennuushe—Filth Eaters
- Ashkapkawia—Bad War Deeds
- Bilikooshe—Whistling Water
- Ashxache—Hair Left on the Hide Lodge
- Ishaashkapaaleete—Cropped Ear Pets Lodge
- Ishaashkakaawia—Furious Pets Lodge
- Ashbatshua—Traitorous Lodge

Of these three are extinct and the remaining 10 recognized clans have been consolidated into the following six; Bad War Deeds, Big Lodges, Greasy Mouths, Ties Things Into a Bundle, Traitorous Lodge, and Whistling Water. (Reed, G. 2002)

The Crow people were originally party of the Hidatsa Tribe, which originated in the upper mid-west of the present U.S. Their subsistence and lifestyle was agriculture based. The Mountain Crow separated from the Hidatsa in North Dakota in the 1550s into eastern Montana and during the 1600s expanded along the Yellowstone River drainage. The River Crow moved into central Montana in 1670 and by 1720 were concentrated in the Yellowstone and Bighorn River drainages.

With the introduction of the horse, people in the Plains tribes became more mobile and began intruding on each other's hunting grounds. The Crow became known for their skill with horses. By 1800 the Powder, Bighorn, Yellowstone, and Wind River drainages became areas of continuing conflict between the Lakota, Northern Cheyenne, Arapaho, Blackfeet, Gros Ventre, Assiniboine, and Crow.

In 1806, the Lewis and Clark expedition spent one month in the Crow Territory, which aided in the Crow developing good relations with fur traders. Fur trading posts were established and fostered the development of the Crow as middlemen in the regional transfer of goods and the Crow prospered. The 1840s saw a period of massive small pox and flu epidemics in which, along with battles between native peoples, the majority of Crow died.

Treaties were signed with the U.S. in 1825, 1851, and 1868. The 1825 Treaty, a treaty of friendship, established a relationship with the U.S. Government. In the Fort Laramie Treaty of 1851, the Crow lost control of the Powder River Basin but gained a promise of peace and annuities that were to be supplied for 50 years. The treaty resulted in some gains but friction continued from tribes who were attracted to the game in the region and by wagon trains of gold seekers making their way to the California or other gold fields. The Crow were busy protecting their territorial boundaries.

Continued conflict in the region led the U.S. government to propose the Fort Laramie Treaty of 1868, which provided territories for individual tribes and closed the Bozeman trail and its forts. In this treaty, the Crow lost lands north of Yellowstone, south of the Montana territorial border, and east of the 107th Meridian.

In 1869, the U.S. government established the Crow Agency near present-day Livingston, Montana. Conditions became sufficiently bad on the reservation that by 1872 the River Crow returned to their Missouri River hunting grounds while the Mountain Crow attempted farming on the reservation. In 1876, the Crow joined the U.S. in a war against the Sioux, Cheyenne, and Arapaho.

The Crow struggled against tradition and the elements to develop farming on the reservation and at times obtained permission to leave the reservation to hunt. White settlers and miners continued to place pressure on the Crow lands. The crow ceded the western boundaries of their land, one-quarter of their reservation, in the How-How Treaty of 1882 in exchange for houses and livestock. In the 1891 Act, the Crow ceded the western third of their reservation and in 1905 more land was ceded.

In the Crow perception of the world there is not a clear distinction between the western perception of spiritual and physical. All things in the universe are living entities: animals, plants, forces of nature, topographic features. The Supreme Force (First Maker) designed the universe and the Crow show their respect for these blessings through their daily life (customs, traditions, and practices). First Maker instilled the universe with baxpe or spiritualness. They maintain an intimate personal relationship with all things in the world around them and the spiritualness that they possess. By treating all things in a respectful fashion, the Crow can continue to survive.

The Crow historical perspective sees time as interlinked so that there is an intimate relationship between the individual and the past. The past (tradition or time) provides the template for the appropriate way to live. The Crow live in constant presence with the past that truly transcends the western concept of time. There are five qualities of time; sacred time, ancient Indian time, historic time, the present, and the future, which have some sequential qualities but for the Crow the spiritualness of these times is most important.

In this world perception many landscapes and places are sacred. They are sacred because they represent why and how things are done. Sacred sites include cultural material scatters, petroglyphs, tipi rings, homesteads, burial areas, cairns, communal kills, fasting beds, medicine lodges, rock art, stone rings, and settlements. Sacred locations and places include water (springs and rivers), spirit homes (springs, rivers, hills, and mountains), landscapes (mountains and topographic features), plant and animal procurement areas, fossil areas, and mineral locations.

Geology and Minerals

The reservation contains a varied geology, as does the State of Montana (see earlier Geology and Minerals description). Of particular interest to this EIS are the deposits of subbituminous coal within the reservation. The known coal occurrences in the Powder River Basin are generally located in the Paleocene Fort Union Formation. Coal on the reservation is produced primarily from nine coal beds:

1. Roland: Top of Tongue River Member; average thickness 9 feet; resources 0.3 billion short tons; ranges in calorific value from 7,021 to 9,114 BTU, the sulfur content is 0.2 to 0.7 percent, and ash content 3.8 to 9.7 percent.

2. Smith: Tongue River Member; average thickness 7 feet; resources 0.3 billion short tons; ranges in calorific value from 7,607 to 8,272 BTU, the sulfur content is 0.6 to 1.0 percent, and ash content 6.8 to 30.2 percent.

3. Anderson: Tongue River Member; average thickness 20 feet; resources 1.9 billion short tons; ranges in calorific value from 8,705 to 9,850 BTU, the sulfur content is 0.2 to 0.6 percent, and ash content 2.9 to 6.2 percent.

4. Dietz: Tongue River Member; two coal beds; average thickness 35 feet; resources 5.6 billion short tons; ranges in calorific value from 6,019 to 9,373 BTU, the sulfur content is 0.3 to 0.4 percent, and ash content 2.9 to 6.3 percent.

5. Canyon: Tongue River Member; average thickness 20 feet; resources 3.7 billion short tons; ranges in

calorific value from 8,446 to 9,113 BTU, the sulfur content is 0.2 to 0.3 percent, and ash content 3.2 to 10.7 percent.

6. Wall: Tongue River Member; average thickness 20 feet; resources 4.9 billion short tons; ranges in calorific value from 7,637 to 10,079 BTU, the sulfur content is 0.1 to 1.1 percent, and ash content 3.1 to 12.5 percent.

7. Rosebud: Tongue River Member; average thickness 10 feet; resources 0.1 billion short tons; ranges in calorific value from 7,810 to 9,090 BTU, the sulfur content is 0.5 to 1.1 percent, and ash content 8.1 to 12.6 percent.

8. McKay: Tongue River Member; average thickness 10 feet; resources 0.1 billion short tons.

9. Robison: Tongue River Member; average thickness 10 feet; resources 0.05 billion short tons.

The coals occur on the east side of the reservation in a 12 to 15 mile wide area, extending from the Wyoming border to the north border of the reservation.

These deposits have been estimated to contain 17.1 billion short tons of coal of which 16.1 billion tons may be prospective for CBM development (Crow Tribe 2002). The aggregate thickness of these coals may be as thick as 100 feet in places (Admin. Report BIA-7, 1975). Geology and stratigraphy of the planning area are discussed at length in the Minerals Appendix.

The Absaloka coal mine produces coal from a strip of land the Crow Tribe ceded in 1904 to the U.S. for settlement by non-Indians. The U.S. holds rights to minerals underlying the ceded strip in trust for the tribe. In 1972, with the approval of the Department of the Interior and pursuant to the Indian Mineral Leasing Act of 1938, Westmoreland Resources, Inc., a non-Indian company, entered into a mining lease with the tribe for coal underlying the ceded strip (Supreme Court May 1998). Today the Absaloka mine annually produces an average of 5,500,000 short tons of coal from its 5,400-acre permitted facility.

The reservation also includes the Soap Creek, Lodge Grass, Gray Blanket, Hardin, and Ash Creek oil and gas fields. There have been 172 conventional wells drilled to date on the reservation. Production occurs from the Fort Union, Shannon, Tensleep, Amsden, and Madison formations within the reservation (Crow Tribe 2002).

Protecting the Indian lessors from loss of royalty as a result of conventional oil and gas drainage is a prime responsibility of the BLM. Under the terms of both federal and Indian leases, the lessee has the obligation to protect the leased land from drainage by drilling and producing any well(s) that are necessary to protect the lease from drainage, or in lieu thereof and with the consent of the authorized officer, by paying compensatory royalty. Drainage analysis, on the basis of a production screen or other criteria, is required by BLM document H-3160-2, Drainage Protection Guidelines Instruction Memorandum. Under this memorandum, federal or Indian mineral interests determined to be in danger of drainage will be subject to geologic, engineering, and economic analyses in order to define the presence and magnitude of resource drainage.

Hydrology

Hydrological resources on the reservation consist of surface water flow from several rivers and their associated tributaries, and the production of groundwater from a variety of geological formations. A detailed explanation of the regional hydrology including that of the reservations is included in an earlier section of this chapter under Hydrology.

The Crow Indian Reservation is within that portion of the CBM-emphasis area associated with the Billings RMP area. The three major drainages on the Crow Reservation are the Bighorn River, Little Bighorn River, and Pryor Creek (Crow Tribe 2002). Three additional drainage basins partially headwatered on the reservation are Bighorn Lake (on the Bighorn River), the upper Tongue River, and Rosebud Creek. Collectively, these drainages are part of the Yellowstone River basin (Crow Tribe 2002).

Water quality in the rivers and streams on the reservation is reported to be generally good, with levels of dissolved solids naturally high (Crow Tribe 2002). Pollution problems (primarily high sediment and salinity levels) are primarily related to non-point source agricultural practices and return flows. Table WIL-2 in the Wildlife Appendix summarizes aquatic resources characteristics and resource values from the Montana NRIS (2001) Internet database for several representative drainages on the Crow Reservation, including the upper and lower Bighorn River, the Little Bighorn River, the upper Tongue River, and Rosebud Creek.

According to the 1996 303d list, several watersheds and impaired water bodies are adjacent to the Crow Reservation. These include the Rosebud watershed which crosses a part of the Crow Reservation; The Lower Bighorn watershed includes a large part of the Crow Reservation, which contacts both impaired portions of the Bighorn River; and the Little Bighorn

watershed that includes a large part of the Crow Reservation, but no water bodies are determined to be impaired on the 1996 303d list.

Most streams experience an increase in concentrations of dissolved solids downstream because of irrigation return flow, increased base flow contributions, and pollution from human activities. Water contributed as base flow water has been in contact with soil and rocks for long periods of time. It therefore contains larger concentrations of dissolved solids than surface runoff water (Crow Tribe 2002).

Surface water quality in the Little Bighorn River basin is affected by high-quality Big Horn Mountain snowmelt, surface- and ground-water inflow, and irrigation in Montana. As in most semi-arid areas, the concentration of dissolved materials in effluent streams generally increases with distance downstream. The total sediment load is large, ranging between 158 and 16,200 tons/day for the Little Bighorn below Pass Creek. Other than its high suspended sediment concentrations, water in the Little Bighorn River can be characterized as very good water that is suitable for most uses.

Snowmelt, ground- and surface-water inflow, geology, and irrigation affect water quality in the creeks draining into the Tongue River. The chemical quality of these creeks is suitable for most uses, although the high hardness and alkalinity values might require treatment for some industrial uses. Again, water quality in these creeks degrades with increasing distance downstream. Based on an analysis for the referenced document, water in Squirrel Creek failed to meet the Secondary Drinking Water Standards for Total Dissolved Solids. Surface and groundwater inflows as well as evaporation, degrade water quality in Rosebud Creek (Crow Tribe 2002).

The groundwater resources for the reservation are more diverse than to those described for the Powder River Basin in the previous Hydrology section of this chapter. The potential for groundwater resources underlies most of the Crow Reservation. The stratigraphy varies from Pre-Cambrian age granitic gneiss and schist in the Big Horn and Pryor mountains on the west to the Eocene deposits of the Wasatch Formation in the Wolf Mountains and Powder River Basin on the east. The pronounced geologic structures, semi-arid climate, and sculptured terrain lead to highly varied, but often prolific, groundwater resources within the reservation. Regional aquifers located on the reservation include the following:

- Alluvial sand and gravel (Holocene)
- Terrace gravel (Pleistocene)
- Clinker deposits (Holocene, Pleistocene, and Pliocene)
- Fort Union Formation (Paleocene)
- Fox Hills—Hell Creek sandstone (Upper Cretaceous)
- Eagle Sandstone (Upper Cretaceous)
- Parkman Sandstone (Upper Cretaceous)
- Pryor Conglomerate (Lower Cretaceous)
- Tensleep Formation (Pennsylvanian)
- Mission Canyon limestone of the Madison Group (Mississippian)
- Jefferson limestone (Ordovician)

Locally many other water-bearing zones may occur in isolated sandstone and siltstone beds, and in fractured bedrock of any type (Crow Tribe 2002). A total of 2,237 wells have been registered with the MBMG. The majority of the wells are producing at depths less than 200 feet bgs and only 30 wells have been drilled deeper than 700 feet bgs. The majority of the wells are used for stock water, irrigation and domestic consumption (Crow Tribe 2002).

Groundwater quality under the reservation is summarized on Table 3-16.

Land Use and Realty

The Crow Reservation comprises approximately 9 percent of the land in the planning area. Of the approximately 1.5 million acres of tribal or allotted trust ownership, 68 percent is grazing rangeland, 12 percent is dry cropland, 3 percent is irrigated cropland, 1 percent is forested, 1 percent is wildland, and 1 percent is developed area (Crow Tribe 2002). The Crow maintain almost 1.2 million acres of leased grazing lands, 150,000 acres leased dry-farming land, and the nearly 30,000 acres leased irrigated farming land. Most lands are leased to large non-Indian interests by Allottees (U.S. Department of Commerce 1996).

TABLE 3-16
GROUNDWATER SODIUM ABSORPTION RATIO AND TOTAL DISSOLVED SOLIDS VALUES
CROW INDIAN RESERVATION

Study Area	Formation	# Wells	Avg. SAR	SAR Range	Avg. TDS	TDS Range
Hardin 3 (NE)	Fort Union	22/2	4.7/43	55 – 0.4		
		36			1,794	405 – 4,672
	Quaternary	16	4.36	32 – 0.1	1,487	184 – 3,920
	Judith River	1		0.7		405
Hardin 4 (NW)	Quaternary	15	7.3	15 – 1	2,859	6,570 – 724
	Unknown	9	9	47 – 0.1	2,223	4,770 – 606
	Pre Judith River	2		0.5 – 0.4		3,170 – 2790
Hardin 5 (SW)	Quaternary	6	4	7 – 2	2,871	806 – 5,850
	Unknown	1		12		614
	Pre Judith River	2		52 – 0.4		4,990 – 2,065
Hardin 6 (SE)	Quaternary	14	1.9	11 – 0.7	1,318	7,720 – 400
	Judith River	3	54	64 – 47	1,107	1180 – 1,000
	Pre Judith River	3	50	82 - 23	3,126	8,060 – 452

Miller et al. 1977
SAR is sodium absorption ratio
TDS is total dissolved solids
Avg. is average
(Crow Tribe 2002)

The principal communities located on the Crow Reservation are as follows:

- Crow Agency—The Crow Tribal Government administration, the BIA, and the Crow Hospital are located in the town of Crow Agency. There are approximately 3,245 Indian people residing in Crow Agency. A 16-bed hospital is located in Hardin, Montana, approximately 12 miles from Crow Agency. Two larger hospitals (250+ bed facilities) are located in Billings, Montana, 65 miles from Crow Agency. Billings is recognized as the major medical referral center for east-central Montana and northern Wyoming.

- Lodge Grass—The Lodge Grass is located approximately 22 miles south of Crow Agency and houses the Lodge Grass Health Center. Approximately 2,125 Indian people live in Lodge Grass.

- Pryor—The Pryor Health Station is located here, approximately 69 miles northwest of Crow Agency. The Indian population of Pryor is estimated at 1,018.

- Wyola—This community is located approximately 13 miles from Lodge Grass and approximately 35 miles from Crow Agency. There are nearly 450 Indian people residing in Wyola.

Paleontological Resources

The Crow Reservation includes bedrock deposited during the Late Cretaceous to Early Tertiary time. These geologic formations were deposited in a broad, epicontinental seaway that extended through the western interior from the Arctic Ocean to the Gulf of Mexico during Late Cretaceous. The cyclic transgression and regression of the shallow seas and the final withdrawal during the Late Tertiary time resulted in a wide variety of environments of deposition. The depositional environments of marine and nonmarine sedimentation resulted in a rich fossil record including dinosaurs, mammals, and other vertebrate and paleobotanical remains. The great abundance, diversity, and generally excellent fossil

preservation in the region present significant scientific research opportunities.

Detailed paleontological field surveys have not been conducted within the reservation. The formations listed below are known to yield paleontological material across Montana:

- Wasatch—has yielded mammals and plant fossils
- Fort Union—various non-marine animals and plants
- Fox Hills-Hell Creek—marine and non-marine animals including dinosaurs
- Bearpaw, Judith River, Claggett—marine animals and dinosaurs
- Morrison—dinosaurs and early mammals
- Swift and Rierdon—marine invertebrates
- Madison—marine invertebrates

Site-specific studies would need to be conducted prior to bedrock disturbance (Crow Tribe 2002).

Recreation

The Crow Indian Reservation is a large contiguous tract of land that provides dispersed outdoor recreation for tribal members. This includes hunting, fishing, picnicking, camping, hiking, horseback riding, snowmobiling, and off-road vehicle use. Yellowtail Dam at Big Horn Canyon provides some of the finest fishing, water sports and camping in the State of Montana. Non-tribal members are not allowed to hunt on the reservation except for spouses of tribal members. Crow Agency recreational facilities are provided at three city parks, the school gymnasium, playground areas, and the Crow Tribal Fairgrounds. Within the town of Lodge Grass on the reservation, there is a city park with landscaped open space and picnic facilities. Outdoor sports and playground equipment are available on the school grounds in Lodge Grass.

The Crow Tribe hosts one of the largest powwows held in the U.S., The Crow Fair, it takes place at the Crow Agency every August. There is spirited competition dancing, drumming, and singing, as well as food and craft concessions. Crow Agency is also near the Battle of the Little Big Horn National Monument, a popular tourist site. Once each year the tribe does a brilliant re-enactment of the battle.

Soils

Soils in the reservation, just like soils in the surrounding area, are derived mainly from sedimentary bedrock and alluvium. The soils generally range from loams to clays, but are principally loams to silty clay loams. For more information on soil types, see the Soils Appendix.

Vegetation

The major native plant communities on Crow Lands include grass and shrub rangelands, forestlands, riparian areas, and barren lands. These classifications are discussed in detail in the Vegetation section.

Rangelands on the reservations are mostly mixed grass prairie in the lowlands and mixed grass, ponderosa pine (*Pinus ponderosa*), Rocky Mountain juniper (*Juniperus scopulorum*), and Douglas fir (*Pseudostuga menziesii*) in foothill and mountain areas (Crow Tribe et al. 1997). Predominant rangeland species are bluebunch wheatgrass (*Pseudoroegneria/Agropyron spicata*), western wheatgrass (*Agropyron smithii*), Idaho fescue (*Festuca idahoensis*), green needlegrass (*Stipa viridula*), needle and thread (*Stipa comata*), little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*), and sideoats grama (*B. curtipendula*). Other species of grass such as switchgrass (*Panicum virgatum*), Indian ricegrass (*Oryzopsis hymenoides*), big bluestem (*Andropogon gerardii*), prairie sandreed (*Calamovilfa longifolia*), and little bluestem are found on sandy sites.

Riparian species include prairie cordgrass, rushes, and sedges. Forbs include lupine (*Lupinus* spp.), Hood's phlox (*Phlox hoodi*), green sagewort (*Artemisia campestris*), cudweed sagewort (*Artemisia ludoviciana*), fringed sagewort (*Artemisia frigida*), white loco (*Oxytropis lambertii*), povertyweed (*Monolepis* sp.), and scurf pea (*Psoralea tenuiflora*). Shrubs include big sagebrush (*Artemisia tridentata*), rabbitbrush (*Chysothamnus* spp.), snowberry (*Symphoricarpus albus*), greasewood (*Sarcobatus vermiculatus*), and snakeweed (*Gutierrezia sarothrae*) (Crow Tribe 2002).

Forestlands on tribal lands are mainly in the higher elevations in the Wolf Mountains, Bighorn Mountains, and Pryor Mountains. Ponderosa pine is the dominant tree with aspen (*Populus tremuloides*) stands also present in some drainages.

Riparian zones are the smallest land cover type on the Crow Reservation (Crow Tribe et al. 1997). Dominant vegetation in these linear strands along rivers and streams are cottonwood (*Populus* spp.), boxelder (*Acer*

negundo), green ash (*Fraxinus pennsylvania*), sandbar willow (*Salix interior*), and American plum (*Prunus americana*). These areas can also have a thick understory of shrubs, if livestock access to them is limited.

Special Status Species

Four plant species of special concern to the State of Montana that occur on tribal lands are sweetwater milkvetch (*Astragalus areetioides*), Joe Pye weed (*Eupatorium maculatum* var. *bruneri*), Purpus' sullivantia (*Sullivantia hapemanii* var. *hapemanii*), and tall centaury (*Centaurium exaltatum*). See the Vegetation Appendix Table VEG-6 for habitat information for these species.

There are certain other plant species that are sacred to the Crow Nation for traditional and/or therapeutic reasons. These special status plants are in addition to those listed under the Vegetation section for the total project area.

Noxious weeds are similar on the Crow Reservation to the rest of the project area and are discussed under the main Vegetation section in this EIS.

Wildlife

According to the Crow Indian Reservation Natural, Socio-Economic and Cultural Resources Assessment and Conditions Report there are an estimated 79 species of mammals, 260 species of birds, five species of amphibians, and 14 species of reptiles found on the Crow Reservation some time during the year. Big game species include pronghorn antelope, elk, white-tailed deer, buffalo and black bear. Small game animals include white-tailed jackrabbit, snowshoe hare, and mountain cottontail. Upland game birds include Merriam's turkey, mourning dove, blue grouse, ruffled grouse, sharp-tailed grouse, sage grouse, chukar partridge, ring-necked pheasant, and gray partridge.

Fur bearers on the reservation include: beaver, muskrat, lynx, bobcat, raccoon, red fox, coyote, badger, striped skunk, western spotted skunk, mink, ermine and long tailed weasel. Many species of rodents are found on the reservation, of these the prairie dog is the most important because of it's relationship as prey.

Several raptorial birds are common throughout the area and nest on the reservation. Some of these include the American kestrel, marsh hawk, red-tailed hawk, bald eagle, and golden eagle. Prairie falcons may also reside on the reservation but are considered uncommon.

Special Status Species

Five endangered species may at times be found on the reservation (Crow Tribe of Indians 2002). These are the grizzly bear, gray wolf, black-footed ferret, whooping crane and peregrine falcon. It is unlikely that any of the endangered mammals reside on the reservation. Whooping cranes and peregrine falcons may migrate through the Crow Reservation in the spring and fall months.

Aquatic Resources

The Crow Tribe (2002) reported that 19 species of fish occur on the Crow Reservation at some time during the year. The tribe also stated that Bighorn Lake (impounded by Yellowtail Dam), which begins in Wyoming and runs into the Crow Reservation in Montana, provides some of the finest fishing in the State. The tribe noted that a nationally famous fishery for huge rainbow trout and brown trout occurs in a 12-mile reach of the Bighorn River downstream of Yellowtail Dam.

Water discharged from Bighorn Lake to the river is cool and nutrient-rich, and supports a blue-ribbon trout fishery reported to be the premier tail-water fishery in North America (Crow Tribe 2002). Table WIL-3 (in the Wildlife Appendix) summarizes fish species composition and abundance information from the Montana State Library Natural Resource Information System (Montana NRIS 2001) Internet data base for the same representative drainages on the Crow Reservation that were listed in the preceding paragraph for Table WIL-2 (in the Wildlife Appendix). In addition to these drainages, Pryor Creek in the western portion of the Crow Reservation provides some habitat for rainbow, yellowstone cutthroat, and brook trout and is rated as having a moderate fisheries resource value (Montana NRIS 2001).

Northern Cheyenne Reservation

Much of the information in this section was summarized from The Northern Cheyenne Tribe and Its Reservation: A Report to the U.S. Bureau of Land Management and the State of Montana Department of Natural Resources and Conservation (Northern Cheyenne Tribe April 2002). Readers should refer to that document for more detailed information. This document can be downloaded from MDEQ CBM web page at http://www.deq.state.mt.us/CoalBedMethane/index.asp.

The Northern Cheyenne Indian Reservation occupies about 445,000 acres in eastern Big Horn and southern Rosebud counties, Montana. U.S. Highway 212

provides access. The reservation covers nearly 695 square miles and is bordered on the east by the Tongue River and on the west by the Crow Reservation. According to the BIA Realty Office, the tribe has 442,193 trust acres and 444,000 of surface and mineral estate lands. There are 138,211 individual allotted acres on the reservation.

President Arthur issued an Executive Order establishing the reservation in November of 1884 with a land trust of about 271,000 acres. In 1900, President McKinley issued a second Executive Order on behalf of the Northern Cheyenne that shifted the eastern boundary to the Tongue River, expanding the reservation to its current size. The topography deviates from low, grass-covered hills to high, steep outcroppings and narrow valleys. Elevations range from approximately 3,000 to 5,000 feet.

Tribal Government

The tribe ratified a constitution and bylaws in 1936 according to Indian Reorganization Act rules. The Tribal Constitution was amended in 1960 and 1996. The 1996 amendment initiated a three branch system: Executive Branch, consisting of the Tribal President, Vice President, Secretary and Treasurer; Legislative Branch consisting of the Tribal Council and it committees, and Judicial Branch consisting of the courts. The Tribal Council consists of 11 full-time members, a seat held by the Vice President, five seats each representing one of the districts (Ashland, Birney, Busby, Muddy, and Lame Deer), and five seats allocated among the five districts based on the percentage of Tribal membership. The Tribal President presides over the Tribal Council. The Tribal Council powers include representative, proprietary, fiscal, police, and economic.

In the Executive Branch, the Tribal President and Vice President are elected by the Tribal membership and the Tribal Council appoints the Secretary and Treasurer. The Tribal President oversees the Executive Branch and appoints persons to all Tribal Boards, commissions, departments, and agencies (Culture Committee, Economic Development Committee, Enrollment Committee, Gaming Commission, Land Committee, St. Labre Task Force, Newsletter Committee, Grazing Board, Natural Resource Board, Housing Authority, Utilities Commission, TERO Commission, Board of Health, Ad Hoc Committee, and Credit Committee) and oversees a host of tribal programs.

The reservation court system was updated in 1998 providing for the election of at least two full-time trained court judges and at least three part-time appellate judges appointed by the Tribal President. A Constitutional Court was established to review the constitutionality of Tribal Council ordinances and has the exclusive power to remove a Tribal judge.

Demographics

According to the 2000 Census, the population of the Northern Cheyenne Reservation (reservation) is 4,470 persons, of whom 4,029 are Native Americans. The Northern Cheyenne Tribe report indicates that this number likely underestimates the actual population. Although the Census does not provide estimates of undercounts, the report estimates the actual reservation population could be about 5,000, based on past Census adjustment methods. Tribal enrollment is 8,008 persons, of whom 4,343 live on or near the reservation.

Geographically, the Northern Cheyenne Reservation's most immediate social environment consists of Bighorn and Rosebud counties, the Crow Reservation on the west, and Powder River County to the east. The reservation has a much higher population density than the surrounding counties. According to the 2000 Census, the reservation had 6.4 persons per square mile, several times greater than the surrounding counties, which had 1.4 persons per square mile. The age distribution on the reservation is more heavily weighted toward the young than the surrounding counties. The median age on the reservation is 22.7 years compared to an average of 39.2 years in the three surrounding counties.

According to the 1990 Census, the poverty rate on the reservation was 47 percent. This compares to an average poverty rate of 12 percent for the non-reservation portions of Rosebud and Powder River counties. Additional information on poverty rates, including rates calculated by the BIA, is provided in the Socioeconomics section of Chapter 3.

Social Organization

There is a housing shortage on the reservation. The Northern Cheyenne Report estimates that there are about 1,200 housing units on the reservation to serve a population of about 5,000. As a result, most reservation housing is overcrowded and a number of tribal members commute from off-reservation housing to jobs on the reservation. Of the 1,200 housing units, about 800 are public housing managed by the Northern Cheyenne Housing Authority, about 20 units are employer-owned housing, and about 300 units are privately owned. In addition, there is an unknown number of mobile homes and trailers. Overall, the

housing on the reservation is in poor condition, due to a number of factors including age, poor construction, and lack of financial resources to maintain it. A significant number of the housing units do not have regular electrical service.

The tribe operates two programs intended to address the housing situation on the reservation—the Northern Cheyenne Housing Authority, which is responsible for new public housing construction and renovation projects, and the Housing Improvement Program, which provides funding for the renovation of private homes on the reservation.

The report provides a detailed description of public services and facilities, including utilities, education, social services, police, fire and medical services, employment and job training, and transportation. A common theme with a number of the services is their inadequacy due to maintenance or capacity issues. A number of basic programs and services on the reservation are still administered by the federal government. The BIA is directly responsible for providing law enforcement services and also manages the reservation's forests and range lands. The BIA is responsible for the reservation's road network and oversees all real estate transactions.

Public schools are available for pre-school grades, and K-12 in Lame Deer. Ashland houses the St. Labre Indian High School or students may decide to attend public high school in Colstrip, Montana. In Colstrip there are three public elementary schools, a middle school, and a transportation system, which serves all grade levels. For college, students may choose to attend the Dull Knife Community College in Lame Deer. The institution offers several associate degrees and certified programs. Dull Knife Community College also offers courses on the Cheyenne language. Approximately 62 percent of the tribal members have a high school diploma and 5.6 percent have a Bachelor's Degree or higher.

Economics

The current economy is primarily based on livestock; individual tribal members own an estimated 12 to 15 thousand head of cattle, which are presently worth about $12 million on the open market. The tribe has approximately 27,000 acres of reservation lands presently under cultivation, the vast majority of which is dryland farming. This primarily entails hay, wheat, barley, and small grains. Annual revenues generated by farming are estimated at about $2.5 million (U.S. Department of Commerce 1996).

In addition to this agricultural-based income, the tribe has developed several secondary routes of income including construction, timber sales, small business, light manufacturing and casino gaming.

There are several skilled construction contractors and subcontractors amongst the tribe, one of which is reported to have a contract for construction of the new Community Center (the old one having burned down in 1989). Additionally, new tribal housing units are planned; tribally based contractors are bidding for this project. In general, the construction industry generates sizable employment and revenues for the tribe.

One third of the reservation or approximately 147,000 acres is composed of forested land, the majority of which is comprised of Ponderosa Pine forests. The commercially available portion of the these forested lands is estimated at 70 percent. The Northern Cheyenne Pine Company is the lead forest product company using reservation timber resources.

There are currently 44 small businesses on the reservation, the majority Indian-owned. These businesses include laundromats, restaurants, gas stations, grocery stores, construction contractors, drilling companies, a lumber mill, a clothing designer, and Indian arts and crafts outlets. The reservation also hosts several light manufacturing facilities.

Recently the tribe opened the Northern Cheyenne Bingo facility, a moderate-sized casino operation, offering bingo, pull tabs, and video poker. Although new, it generates nearly $11,000 a week in revenues and employs a number of tribal members.

Additional Detail

The information that follows was summarized from a report by the Northern Cheyenne Tribe (April 2002). Readers should refer to that document for more detailed information.

According to the 1999 BIA Labor Force Report, only 29 percent of the potential 2,437-person labor force on the reservation is employed; the unemployment rate is 71 percent. For further discussion, see Table 3-15 and the text in the Social and Economic Values section under the heading of Unemployment.

A detailed discussion of the history of reservation employment and economics in relation to energy production is provided in the Northern Cheyenne report. The report reviews the energy development between 1970 and 1990 and the associated rise and then fall of wages, employment, and property taxes in the reservation area. The primary local economic impact of the mineral development during that time

was in the creation of jobs and payment of wages, in addition to state and local taxes collected on mineral extraction. Energy and extraction provided some of the highest-paying jobs available in Montana.

Despite the new wealth and jobs created, the energy boom from 1970 to 1990 generally did not support improved prosperity on the reservation. On the reservation, a number of indicators of economic health declined during this period. Reasons cited for this deterioration of economic conditions include lack of access by Northern Cheyenne to the high-paid energy jobs, limited local commercial infrastructure on the reservation, and lack of access to the energy-related revenues to support public services and infrastructure on the reservation.

The federal government plays a major role in tribal economics. Direct federal funding in the form of grants, contracts, and funding agreements and indirect costs recovery make up the lion's share of the tribe's total revenues and expenditures. Between 1976 and 1997, the Northern Cheyenne Tribe entered into contracts with the BIA assuming responsibility for more than 20 BIA programs with a total budget in fiscal year 2002 of $3.7 million. The tribe also enters into funding agreements with the Indian Health Service, and federal housing, welfare, and employment programs. In all, the tribe administers about 70 federal grants and programs with a combined value in fiscal year 2002 of about $21.3 million. In fiscal year 2002, federal funding for direct and indirect program expenditures is projected to exceed the tribe's general fund revenues by a factor of 10.

Sources of tribal government fiscal resources include the general fund, indirect cost reimbursement, fiduciary funds, and special revenue funds. The general fund is used to finance the basic operations of tribal government. The fund is also used to provide matching funds for federal programs and to subsidize under-funded federal programs. General fund revenues are derived from income from tribal natural resources (primarily timber sales and grazing leases), earnings distributed from the permanent fund, interest on other funds, and federal payments in lieu of taxes. Because the reservation tax base is limited, the tribe imposes no taxes and derives no revenues from taxation. The general fund budget for fiscal year 2002 is $2.03 million, which represents a 40 percent decline from 2001, primarily due to decreased earnings distribution from the permanent fund and declining income from natural resources. Tribal discretionary funds—those funds available to fund the operations of the tribal government and discretionary programs and services—are limited.

Air Quality

The air quality and climate of the Northern Cheyenne Reservation is similar to that of the regions described earlier in Chapter 3. The Northern Cheyenne Reservation is classified as a PSD Class I area. Additionally, the community of Lame Deer, Montana, is classified as a moderate PM_{10} nonattainment area.

The tribe is under contract with Pennsylvania Power and Light to maintain, calibrate, and report data from three ambient air PSD stations. These stations are used to monitor SO_2, NO_2, wind speed and direction, precipitation, barometric pressure, solar radiation, temperature and dew point. Background data from two of these stations for the January 1999 through June 2000 period indicate the maximum hourly concentration for SO_2 was 0.021 ppm and for NO_2, 0.034 ppm. However, the annual averages remain very close to zero.

Particulate matter (PM_{10} and PM2.5) ambient air monitoring is conducted in the community of Lame Deer. No exceedances of the NAAQS were noted in the years 1999 to 2000. Daily PM_{10} values ranged from 1.6 ug/m3 to 131.3 ug/m3. The PM_{10}, 24-hour average "not to exceed" value is 150 ug/m3.

The tribe is in the process of developing a Tribal Implementation Plan, which will allow for enforcement of Class I air quality standards.

The reservation is located in a part of Montana that has a moderate climate relative to its latitude. Snow rarely accrues for long periods of time because of the warm Chinook winds, which originate from the mountains in the West. This portion of Montana is also known for its "Indian Summers" which frequently extend into November. The mean annual temperature is 45.5°F with a summer high of 110°F and a winter low of -48°F. The bulk of the reservation varies from 12 to 18 inches annual precipitation, depending on the elevation.

Culture and History

The Cheyenne are believed to descend from the Algonquian language people in the Great Lakes region, what the Northern Cheyenne call the northern homelands (Notum'histah'o'omih'nah). Western scientists believe that during the 1400s and 1500s they migrated southward into the Missouri River and the Black Hills country. The Northern Cheyenne believe that they left the Great Lakes region about 1600 to avoid contact with encroaching Europeans. They farmed corn and squash and practiced subsistence fishing and gathering and hunting small game. While in

the Missouri River region they encountered a group of Suhtio and they later integrated their beliefs, traditions, and customs into one culture.

After 1600 they adopted the horse and became reliant on large game hunting and following the buffalo herds. From around 1640 to 1830, the Cheyenne engaged in commerce with Europeans as part of the fur trade, encountering the Lewis and Clark expedition about 1804.

The first treaty with the U.S. government was signed by a small group of Cheyenne in 1825 (the Friendship Treaty). In the 1830s, the Cheyenne began to split into the Southern Cheyenne and the Northern Cheyenne, preferring to live close to their Lakota relatives in the Black Hills, Powder River, Yellowstone River, and Tongue River regions.

European settlement, gold seekers, and other Euroamerican activity increased in the region throughout the first half of the 1800s leading to increased conflict, between Native People and with Euroamericans. In an attempt to decrease conflict the U.S. government established military outposts and an Indian Agency in the Upper Platte River Valley. They convinced a number of Native nations to adopt the Fort Laramie Treaty of 1851, which assigned the Cheyenne and Arapaho to lands south of the North Platte River and north of the Arkansas River in present day Wyoming, Nebraska, Colorado, and Kansas. However, some Cheyenne bands remained north of the South Platte River and became known as the Northern Cheyenne. The Northern Cheyenne continued to resist incursions into what they considered their territory. Tensions between Euroamericans and the Northern Cheyenne increased during the Civil War. The Colorado Volunteer Militia raided a peaceful Cheyenne Village culminating in the Sand Creek Massacre. From this point through the late 1870s, the Cheyenne were at war with the U.S. government. The Battle of the Little Bighorn is the most well-known incident of this long struggle.

There were many bands involved in these battles and struggles and their movements were complicated and read like any war story. The Cheyenne were eventually subdued and split into various groups. In 1881, all of the Northern Cheyenne were sent to Fort Keogh and were allowed, under the Indian Homestead Act of 1875, to move south near the Tongue River and along Rosebud and Muddy creeks. The Northern Cheyenne settled in the area practicing their traditional culture and making a livelihood practicing western farming and ranching.

Disputes arose between white ranchers and the Northern Cheyenne leading to a special investigation, the outcome of which was the establishment of the Northern Cheyenne Reservation in 1884. Disagreements over the reservation boundaries continued until 1900 when the current reservation boundaries were established.

The Northern Cheyenne are the people of The Morning Star. They are caretakers of the Sacred Buffalo Hat, a sacred covenant with *Maheo* (Creator). Life for the Northern Cheyenne is a holistic interrelationship of history, work, religion, language, sacred belongings, health, medicine, and education. All of these work to maintain the environment and culture of the people. Their sacred ways, such as the Keeper of the Sacred Buffalo Hat Covenant greeting the grandfather morning star, maintain a connection to *Maheo* and the creative essence that caused the universe and life itself to exist. Ritual and diligence in daily life to follow tradition maintains the elemental arrangement of creation. In this arrangement, all elements of creation are like a family: Sun as Grandfather, Earth as Grandmother, Moon as Mother, Stars as Brothers and Sisters, and to the four cardinal directions as the Sacred Spirit Helpers who watch over their way of life.

An excellent outline and illustration of the Cheyenne cosmology and interrelationships can be found in the report, The "Northern Cheyenne Tribe" and its Reservation (2002), which illustrates the universe as a renewable cycle with spiritual essence in constant interaction. *Maheo*, spiritual essence, is contrasted with *Heestoz*, substance or matter. Both are necessary for the continuation of the universe. Maleness, associated with *Maheo*, is the highest point in the universe and femaleness, associated with *Heestoz*, is the lowest point. The interaction of *Maheo*, Sun (Creator) and *Heh'voom*, earth (Grandmother) bring about all life. Between *Maheo* and *Heh'voom* are layers of space creating the structure of the universe is between. These layers are the Blue-Sky Space, the Nearer-Sky Space, the Atmosphere, the Earth Surface Dome, and the Deep Earth. With this cosmology, birds and mountains are special sacred animals and places since they are closer to Blue-Sky Space containing the manifestation of *Maheo* (sun, moon, etc.). All things in this cosmology are animate.

Through sacred ways and ceremony, the Cheyenne believe that they can harness the spiritual essence as a power to benefit physical existence. If they do not practice traditional culture and beliefs to maintain the balance and cycle, the spiritual essence will not be available to benefit them or maintain the earth system.

With these belief systems natural resources become culturally and spiritually important, particularly water (with living spirits), plants (considered to be relatives), animals (also relatives), great birds (messengers to the spirits in Blue-Sky Space), and fossil and mineral sources (used in ceremony). Cultural resources such as burials, ceremonial sites (fasting locations, vision quest sites, sweet lodges, and memorials), homes (tipi rings, historic depressions, foundations, and cabins), community and commercial reservation-era sites, military and exploration-related sites, and prehistoric sites (lithic scatters, cairns, and petroglyphs) are considered sacred to the Northern Cheyenne.

Geology and Minerals

The reservation contains a varied geology, as does the State of Montana (see earlier Geology and Minerals description). Of particular interest are the deposits of subbituminous coal within the reservation. The known coal occurrences in the Powder River Basin are generally located in the Paleocene Fort Union Formation. The coals on the reservation are known to be beneath the entire reservation and are estimated to contain 23 billion tons of coal of which 16.3 billion tons may be prospective for CBM development (Admin Report BIA-3 1975). Five CBM wells have been drilled prior to 1989 on the reservation with modest results (Northern Cheyenne Tribe 2002). In 1991, the tribe drilled and tested two CBM exploratory wells (Northern Cheyenne Tribe 2002). Geology and stratigraphy of the planning area are discussed at length in Chapter 3, Geology and Minerals and in the Minerals Appendix.

The reservation does not have any known oil or gas fields. Twenty conventional wells have been drilled to date. Additionally, Atlantic Richfield (ARCO) has explored for oil and gas reserves on tribal lands but this data has not been released to state or federal agencies.

Non-metallic mineral resources on the reservation include bentonite, building and ornamental stone, claystone and shale, clinker, and gravel (Northern Cheyenne Tribe 2002).

Protecting the Indian lessors from loss of royalty as a result of conventional oil and gas drainage is a prime responsibility of the BLM. Under the terms of both federal and Indian leases, the lessee has the obligation to protect the leased land from drainage by drilling and producing any well(s) that is necessary to protect the lease from drainage, or in lieu thereof and with the consent of the authorized officer, by paying compensatory royalty. Drainage analysis, on the basis of a production screen or other criteria, is required by BLM Handbook H-3160-2, Drainage Protection Guidelines. Federal or Indian mineral interests determined to be in danger of drainage are subject to geologic, engineering, and economic analyses in order to define the presence and magnitude of resource drainage.

Hydrology

Hydrological resources on the reservation consist of surface water flow from the Rosebud Creek and the Tongue River and their associated tributaries, and the production of groundwater from a variety of geological formations.

Surface Water

Surface water on the reservation is contained in the Rosebud and Tongue River watersheds. These two watersheds support natural flows as summarized in Tables 3-17 and 3-18.

These two watersheds contain water resources of variable quality as described in the Water Resources Technical Report (ALL 2001b). Table 3-19 summarizes the long-term average water quality for the Tongue River watershed.

According to the 1996 State of Montana 303d list, several watersheds and impaired water bodies are adjacent to the Northern Cheyenne Reservation. The probable cause of the impairment is nutrients and the probable source is dam construction and hydro-modification. The Lower Tongue Watershed intersects with the Northern Cheyenne Reservation, which extends up to the Tongue River itself although the reservation does not touch the impaired Tongue River segment. The Rosebud watershed includes most of the Northern Cheyenne Reservation and a part of the Crow Reservation; the Northern Cheyenne Reservation contacts the impaired portion of the Rosebud Creek.

Groundwater

The groundwater resources of the reservation are similar to those described for the Powder River Basin in the previous Hydrology section of this chapter. Formations of importance to the groundwater resources of the reservation include the Madison Group of Mississippian age; the Fox Hills Sandstone and Hell Creek Formation of Cretaceous age; the Fort Union Formation of Tertiary age, and the valley fill-alluvium of Quaternary age. The geologic formations and associated aquifers are discussed below. (Northern Cheyenne Tribe 2002).

TABLE 3-17
AVERAGE ANNUAL GAGE AND ESTIMATED NATURAL FLOWS FOR THE TONGUE RIVER NEAR THE NORTHERN CHEYENNE RESERVATION (STUDY PERIOD 1940-1982, HKM 1983)

Location	Flow Type	Acre-Feet/Year
Tongue River at Tongue River Dam	Gage Flow Est. Natural Flow	332,907 (St. Dev. = 112,406) 421,238 (St. Dev. = 102,464)
Southern Boundary of Reservation	Est. Natural Flow	439,253 (St. Dev. = 106,154)
Northern Boundary of Reservation	Est. Natural Flow	455,161 (St. Dev. = 103,255)
Tongue River at Brandenburg Bridge	Gage Flow Est. Natural Flow	362,614 (St. Dev. = 152,288) 461,019 (St. Dev. = 104,352)

(Northern Cheyenne Tribe 2002)

TABLE 3-18
AVERAGE ESTIMATED NATURAL FLOWS FOR ROSEBUD CREEK, NORTHERN CHEYENNE RESERVATION (STUDY PERIOD 1939-1981)

Estimated Natural Flow at Location	Acre-Feet/Year
Rosebud Creek at Southern Boundary	11,818 (St. Dev. = 6,417)
Rosebud Creek neat Colstrip, Near Northern Boundary	26,727 (St. Dev. = 14,172)
Rosebud Creek near Mouth, Near Rosebud	27,297 (St. Dev. = 18,439

HKM, RCB Hydrology 1982
(Northern Cheyenne Tribe 2002)

TABLE 3-19
COMPARISON OF PREVIOUSLY CITED WATER-QUALITY PARAMETERS WITH LONG-TERM AVERAGE FIGURES, TONGUE RIVER AT STATE LINE

Data Source	Range	Sulfate (mg/l)	Dissolved Magnesium (mg/l)	EC (uS/cm)	SAR	Boron (µg/l)
HKM (1972)	High	500	50	1,100	2.0	0.38
	Low			230		
USGS (1985-1999 average)	Mo. Average High	180	45	699	0.67[1]	<1
	Mo. Average Low	30	10	299		

[1]SAR = 0.67 reflects published USGS data for water year 1997, as parameter 00931 SAR is not included in data set available on USGS website (Northern Cheyenne Tribe 2002).

Madison Group

The Madison Group is divided into the Lodgepole Limestone at the base, the Mission Canyon Limestone, and the Charles Formation at the top. The Madison Group is estimated to average around 1,100 feet thick within the reservation and the depth to the top is estimated to range between 7,200 and 9,100 feet below land surface. The aquifer contained within the Madison Group reportedly consists of extensive limestone and dolomite with shale, evaporate, and cherty zones. Yields from Madison wells in the area range from 94 gpm immediately NW of the reservation to a reported 2,382 gpm from a flowing well approximately 90 miles NW of the reservation. Better porosity and permeability in the Madison aquifer are mainly associated with oolitic to fragmental limestone and with coarsely crystalline dolomite in the lower part. Solution and collapse breccias occur in the outcrops off the reservation; the extent of these features in the subsurface within the reservation is unknown.

Fox Hills Sandstone

The Fox Hills Sandstone, in the central Powder River Basin east of the reservation, is a sequence of marine and continental sandstone and shale 20 to 200 feet thick. Limited information available from oil and gas test holes on the reservation indicates the thickness of this unit to range from 65 to 760 feet. Depth to the top of the Fox Hills in the reservation is estimated to range between 2,200 and 3,500 feet. The most extensively used aquifer in the Central Powder River Basin is called the Fox Hills-Lower Hell Creek aquifer and it consists of the Fox Hills Sandstone and the overlying lower part of the Hell Creek Formation. Well yields from the Fox Hills-Lower Hell Creek aquifer range from 0.5 to 20 gpm and commonly are about 5 gpm. Yields of as much as 200 gpm to industrial wells have been reported (Slagle et al. 1985).

Hell Creek Formation

The Hell Creek Formation consists of sandstones, interbedded shales, and siltstones. Available data indicates this unit underlies the entire reservation with a thickness of between 600 and 650 feet. Depth to the top of the Hell Creek formation within the reservation is estimated to be greater than 600 feet. Only one well is known to be completed in the Hell Creek formation near the reservation. It was drilled in 1959 for Saint Labre Mission to a total depth of 980 feet. At the time the well was constructed, it was under artesian pressure and flowed at the land surface at a rate of 60 gpm.

Fort Union Formation

The Fort Union Formation consists of the Tullock, Lebo Shale, and Tongue River members. The total thickness of this formation within the reservation is estimated to range from 1,800 to 2,200 feet. The formation dips to the southeast at 1 to 2 degrees regionally.

Tullock Member

The Tullock Member of the Fort Union Formation is estimated to range between 100 and 250 feet thick on the reservation and consists of sandstone, coal, and shale beds. This unit is not a known source of water on the reservation. Yields to wells completed off the reservation in the Tullock Member range from about 0.3 to 40 gpm and generally are about 15 gpm (Slagle et al. 1985).

Lebo Shale Member

The Lebo Shale Member of the Fort Union Formation consists of dark shale and reportedly contains some lignite beds but no coal. The thickness of this unit on the reservation is estimated to range between 100 and 300 feet. It is not a known source of water.

Tongue River Member

The Tongue River Member of the Fort Union Formation is the major source of water withdrawn from wells in the northern Powder River Basin (Slagle 1985). It is the most reliable and shallow aquifer underlying most of the area, including the Northern Cheyenne Reservation. There are more than 100 springs on the Northern Cheyenne Reservation. Many of these springs emanate from the base of a clinker-shale contact, very commonly in the Tongue River Member of the Fort Union Formation. The springs may be quite vulnerable to the effects of regional aquifer drawdown. Depending on the geologic location of the spring, yield can range from 1 to 92 gpm.

Lower Tongue River Aquifer

The Lower Tongue River aquifer consists of the sandstone, siltstone, shale, coal, and clinker beds from the base of the Robinson coal seam to the shale beneath the Knobloch coal seam. The aquifer is generally around 500 feet thick, except in the major stream valleys where erosion has reduced the total thickness to between 300 and 450 feet thick. Drill hole data indicates beds of permeable sandstone and shale are discontinuous and occur primarily as lenses grading from shale to siltstones.

Several wells are known to be completed in the Lower Tongue River aquifer. Most of these domestic wells were completed in sandstone and yield between 8 and 20 gpm. Wells in Muddy Cluster and Busby finished in the sandstone reportedly yield 18 and 50 gpm, respectively.

Upper Tongue River Aquifer

The Tongue River Member is Tertiary in age and crops out at the surface over much of the reservation. The Upper Tongue River aquifer consists of the sandstone and clinker beds within the Knobloch, Wall, and Anderson systems.

Knobloch System. This unit consists of sandstone, siltstone, shale, coal, and clinker. The Knobloch system ranges from 0 to 366 feet in thickness. Depth to the top of the unit is generally less than 1,100 feet depending on location on the reservation. Many wells and springs obtain groundwater from this system. Yields of wells completed in the sandstone generally range between 8 and 10 gpm. Wells completed in the Knobloch clinker yield as much as 50 gpm. Springs associated with sandstone and coal outcrops of the Knobloch generally flow less than 3 gpm.

Wall System. The Wall system consists of sandstone, siltstone, shale, coal, and clinker. It ranges in thickness from 0 to 790 feet. Beds of permeable sandstone are discontinuous and occur primarily as lenses between shale and siltstone layers. Depth to the top of the unit is generally less than 300 feet depending on location on the reservation. The Wall coal seam and its related clinker form the thickest most continuous unit of this system, ranging from 20 to 40 feet. The Canyon coal seam, within the Wall system, also forms a relatively thick and continuous unit (20 to 30 feet). Several wells and springs derive water from the Wall system. Well yield ranges from 10 to 15 gpm. Springs flow from sandstone, siltstone, and clinker units and vary from 1 to 25 gpm within the reservation.

Anderson System. This system consists of fine sandstone, siltstone, shale, coal, and clinker ranging in thickness from 0 to 300 feet. The Anderson coal seam and its related clinker deposits form the thickest single unit within this system. Thickness of the Anderson coal varies from 30 to 60 feet but thins to the west. Massive clinker related to the burning of the Anderson and thin upper coal seams is reported to vary from 100 to 200 feet in the central and northern portions of the reservation.

Several wells and springs are known to derive water from the Anderson aquifer system. No production data is available as all wells completed before 1977 were monitoring wells. Springs associated with sandstone and siltstone units above the Anderson coal seam generally yield less than 1 gpm within the reservation.

Valley Fill-Alluvium

Valley fill-alluvium is found underlying and bordering the principal drainages within the reservation. These deposits include the Rosebud Creek, Muddy Creek, Lame Deer Creek, and Tongue River alluvium.

Rosebud Creek Alluvium

The Rosebud Creek alluvium consists of clay, silt, sand, gravel, and clinker fragments. Silts and clays are usually found as thin beds separating sand and gravel deposits. According to driller's logs, the Rosebud Creek alluvium ranges in thickness from 6 to 110 feet, with an average thickness of 52 feet. An aquifer test performed in 1978 indicated an average transmissivity of 6,243 ft^2/d for a saturated thickness of approximately 76 feet. This value is considered to be representative of the valley fill alluvium immediately adjacent to Rosebud Creek between the southern reservation boundary and Busby. For wells completed in the Rosebud Creek alluvium, yield ranges between 6 and 20 gpm.

Muddy Creek Alluvium

The Muddy Creek alluvium consists of a mixture of silt, sand, gravel, and clinker fragments. Based on driller's logs, the thickness of these deposits range from 0 to 112 feet and average 52 feet thick. The average saturated thickness is 30 feet. Assuming the deposits are similar to the Rosebud Creek alluvium, a transmissivity of 2,463 ft^2/d is calculated. Several wells, known to be completed in the Muddy Creek alluvium, yield between 10 and 15 gpm for domestic supply.

Lame Deer Creek Alluvium

The Lame Deer Creek alluvium consists of silt, sand, and relatively thick gravel and clinker wash as compared to that of Rosebud and Muddy Creek deposits. Driller's logs indicate that the thickness of this deposit ranges from 12 to 63 feet. Domestic wells completed in the Lame Deer Creek alluvium yield between 6 and 15 gpm.

Tongue River Alluvium

The Tongue River alluvium consists of sand and gravel-sized clinker fragments derived from the Tongue River member of the Fort Union formation.

The thickness of this deposit ranges from 34 to 100 feet and averages 66 feet (Northern Cheyenne Tribe 2002).

Groundwater Quality

A thorough evaluation of groundwater quality was performed by the Northern Cheyenne Research Project from 1973 through 1977, and published by HKM in 1983. The following descriptions are based on the data collected during that study period. The majority of water quality data on the reservation exists for the Fort Union and alluvial aquifers. Individual aquifers are discussed below (Northern Cheyenne Tribe 2002).

Fort Union Formation and Tongue River Member

Samples obtained from wells indicated water in these geologic units to be a mixed type with this dominant ions being sodium, magnesium, calcium, bicarbonate, and sulfate. TDS concentration generally range from 232 to 3,774 mg/l in wells tapping sandstone, coal, and clinker units. Water ranges from soft to very hard with calcium carbonate levels between 14 to 1,468 mg/l. Fluoride concentrations range from 0.1 to 9.1 mg/l and sulfate concentrations range from 0 to 2,119 mg/l. Adjusted SAR values for water samples obtained from the sandstone units of the Tongue River member of the Fort Union formation ranged from 0 to 53. Water samples from the coal beds of the Fort Union had adjusted SAR values ranging from 2.6 to 101. Springs contained very hard water with calcium carbonate concentrations between 190 to 950 mg/l. Sulfate and fluoride concentrations ranged from 8.0 to 337 mg/l and 0.27 to 12.0 mg/l, respectively. The adjusted SAR ranged from 0.5 to 50.8.

Groundwater from sandstone and coal aquifers of the Tongue River Member is generally suitable to serve as a drinking water source; however, several samples from wells obtaining water from the coals did exceed the Primary Drinking Water Standards for chromium and fluoride. Water from the Tongue River aquifers is generally quite mineralized and not aesthetically pleasing. This water is generally undesirable for irrigation due to salinity problems; however, it is acceptable for livestock use.

Valley Fill— Alluvium

Water-quality for the valley fill-alluvium on the reservation appears to be a mixed-type, with the dominant ions being calcium, magnesium, sodium, bicarbonate, and sulfate. A range of water-quality values in the alluvial systems is presented in Table 3-20.

Groundwater from the alluvium is generally suitable for drinking water with respect to the Primary Drinking Water Standards, although several samples taken from wells completed in the alluvium of Rosebud, Muddy, Lame Deer creeks, and the Tongue River, equaled or exceeded the Primary Standards for cadmium. One sample from a well completed in the Rosebud Creek alluvium exceeded the limits for chromium and lead. The alluvial groundwater is quite mineralized with concentrations of TDS, sulfate, iron, and manganese that often exceed Secondary Drinking Water Standards. Exceeding secondary standards does not represent a health hazard, but rather makes the water less desirable as a drinking water source for aesthetic reasons. The alluvial groundwater would probably be suitable for

TABLE 3-20
WATER-QUALITY OF THE ALLUVIUM ON THE NORTHERN CHEYENNE RESERVATION

Constituent	Rosebud Creek	Muddy Creek	Lame Deer Creek	Tongue River
TDS (mg/l)	374 - 2,048	1,082 - 1574	558 – 1,144	527 - 3,277
$CaCO_3$ (mg/l)	140 - 1,225	664 - 955	450 - 626	35 - 946
Sulfate (mg/l)	67 - 1,370	313 - 731	119 - 361	0 - 1,893
Nitrate (mg/l)	0 - 4.0	0 - 1.0	1.0 - 4.3	0.1 - 6.2
Fluoride (mg/l)	0 - 1.3	0.5 - 1.5	0.8 - 2.0	0.3 - 6.4
Adjusted SAR	0 - 34	5.2 - 6.0	5.2 – 6.0	4.3 - 51
No. wells tested	17	5 samples	4	12

(Northern Cheyenne Tribe 2002)

irrigation provided tolerant crops were used and special irrigation practices were instituted to prevent salinity and permeability problems. The water is acceptable for livestock use (Northern Cheyenne Tribe 2002).

Water Rights

The water rights of the Northern Cheyenne Tribe are set forth in the Northern Cheyenne-Montana Compact, which represents a statement of the federally reserved water rights held by the tribe. The Reserved Water Rights Compact Commission (RWRCC) of Montana describes Federal Reserved Water Rights as follows:

Federal Reserved Water Right

A federal reserved water right is a right to water that was created when Congress or the President of the U.S. reserved land out of public domain. The U.S. Supreme Court has ruled that enough water be reserved to meet the purposes for which the reserved lands were designated. The date that the land was withdrawn and the reservation created is the priority date of a federal reserved water right. Reserved water rights for Indian reservations, for instance, go back to the 1800s. Federal reserved water rights do not have the same restrictions placed on them as on state appropriative water rights. For example, a notice of appropriation or beneficial use is not required to maintain a federal reserved right, and it is not lost due to non-use. The Tribe's reserved water right addresses three sources of water, the Tongue River, the Bighorn River, and Rosebud Creek. The Compact entitles the Tribe to a priority date of October 1, 1884. This right provides for:

1. The diversion of 1,800 acre-feet per year, or the amount necessary to irrigate 600 acres, from Rosebud Creek.
2. The diversion of 30,000 acre-feet per year from the Bighorn Lake at Yellowtail Dam for any beneficial use.
3. The diversion of 32,500 acre-feet from the Tongue River for any beneficial use.
4. An additional 19,530 acre-feet from Rosebud Creek, for any beneficial use subject to the constraint that diversion and use do not adversely affect other water right holders of priority June 30, 1973, and earlier.
5. The extraction of alluvial groundwater by means of wells of less than 100 gallons per minute pumping capacity, exclusive of other water rights (Northern Cheyenne Tribe 2002).

History of Compact

In 1913, the state court of Montana initiated a proceeding to adjudicate water rights on Tongue River. In this proceeding, the federal government did not fully satisfy the Northern Cheyenne Tribe's *Winters v. U.S.* (207 US564) water rights claims to water in the Tongue River. Instead, the U.S. asserted a claim on behalf of the tribe only for the amount of water used by the Tribe at that time. In the Miles City Decree of 1914 (the Decree), the tribe was awarded only 30 cfs of water out of an available 425 cfs. The Decree established a priority date of 1909 for the Northern Cheyenne water claim: the next to last priority awarded in the Decree. The tribe's water right as set forth in the Decree was insufficient to irrigate the tribe's agricultural lands at the time and the late priority date established a high probability that the tribe would be out of water before the irrigation season began (Northern Cheyenne Tribe 2002).

The tribe has asserted that the failure to pursue the tribe's *Winters v. U.S.* (207 US564) rights claims constituted a breach of the federal trust responsibility. In 1975, the tribe filed an action in U.S. District Court to determine its water rights. The Untied States also filed suit on behalf of the tribe. In 1979, the State of Montana initiated proceedings for a general stream adjudication, which included the claims of the tribe. In that same year, the estate established the Montana Reserved Water Rights Compact Commission to negotiate a water rights settlement with the tribes of Montana. Negotiations with the Tribe began in 1980. Several years of negotiations yielded the Northern Cheyenne-Montana Water Rights Compact (the Compact). The Tribe formally approved the Compact on May 20, 1991, with Tribal Resolution #144. The Compact was ratified by the Montana State Legislature on June 11, 1991, and was re-ratified on December 16, 1993, by the 53rd Legislature Special Session (Northern Cheyenne Tribe 2002).

On September 30, 1992, the federal government ratified the Compact via "The Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992" (Pub.L. 102-374, 106 Stat. 1186) (Settlement Act). The purposes of the Settlement Act of 1992 are:

> To achieve a fair, equitable, and final settlement of all claims to Federal reserved water rights in the State of Montana of the Northern Cheyenne Tribe and its members and allottees and the U.S. on behalf of the Northern Cheyenne Tribe and its members and allottees. To approve, ratify, and confirm the Water Rights Compact entered into by the Northern Cheyenne Tribe and the State of Montana on June 11, 1991. To direct the Secretary

of the Interior to enter into a cooperative agreement with the State of Montana for the planning, environmental compliance, design, and construction of the Tongue River Dam Project (P.L. 102-374, 106 Stat, 1186, Section 3(8)) in order to: implement the Compact's settlement of the Tribe's reserved water rights claims in the Tongue River Basin, protect existing Tribal contract water rights in the Tongue River Basin: provide [up to as per the Compact] 20,000 acre-feet per year of additional storage water for allocation to the tribe, and allow the State to implement its responsibilities to correct identified Tongue River Dam safety inadequacies. To provide for the conservation and development of fish and wildlife resources in the Tongue River Basin. To provide for the enhancement of fish and wildlife habitat in the Tongue River Basin. To authorize certain modifications to the purposes and operation of the Bighorn Reservoir in order to implement the Compact's settlement of the Tribe's reserved water rights claims. To authorize the Secretary of the Interior to take such other actions as are necessary to implement the Compact.

Northern Cheyenne Tribal Water Policy and Management

Northern Cheyenne Water Code: The Northern Cheyenne Water Code sets the regulatory framework for the management of tribal water resources on the reservation. The purpose of the Water Code is to preserve and protect the quantity and quality of Tribal water resources through wise use, administration, management, and enforcement. This includes, but is not limited to, permitting and prioritizing tribal water use, long-term planning to ensure the sustainability of resources, encouraging conservation practices, and protecting traditional, religious and cultural uses of water (Northern Cheyenne Tribe 2002).

- Tribal Water Resources Board and Administrator: The administration of the Water Code will be the responsibility of a Tribal Water Administrator (TWA) and a Tribal Water Resources Board (Water Board). The Tribal Water Board is responsible for adopting new rules and regulations, approving or disapproving permits, reporting to the Tribal Council on relevant water-related issues, declaring critical management areas and water supply conditions, establishing and maintaining a technical staff to administer and enforce the Code, and developing recommendations for long-term funding sources to support tribal water management.

- The TWA: The TWA issues citations and initiates enforcement proceedings for violations of the Code. The TWA administers water rights, monitors and enforces water use through inspections, responds to emergency situations, collects data and researches development possibilities, and conducts educational programs. Recommendations are made to the Water Board on critical management areas and methods for improving water use and efficiency. The TWA develops and submits an annual budget and report to the Water Board.

- Water Management: The Water Code sets forth the primary physical, hydrologic, and engineering principles guiding the management of surface and groundwater resources on the reservation. These procedures are required to effectively manage, fully utilize, and protect the water rights of the Northern Cheyenne Tribe, and to assure compliance with applicable laws and requirements of the Northern Cheyenne Montana Compact of 1991 and the Northern Cheyenne Water Rights Settlement Act of 1992. The Water Board will adopt a Comprehensive Water Management Plan at least every 5 years to guide water resource decisions, permitting, and management. Surface water and groundwater is evaluated, and no later than March 1 of each year, the condition of these resources is declared. Water allocation procedures for both surface and groundwater are outlined in this section for use during drought conditions.

- Permitting: A water permit is required to divert or undertake any activity affecting or involving tribal water. This includes water diversions, discharge, injection, transfers, surface water alterations, groundwater recharge, storage impoundments, or hydropower generation. The Code clearly identifies the application process outlining the procedures, hearings, and resolution of water disputes. The Water Board will preside over all hearings. The Tribal Court will enforce subpoenas issued by the Water Board.

- Enforcement: Prohibited acts and penalties are clearly outlined in the Water Code. Any person who commits prohibited acts shall be subject to civil proceedings before the Water Board on citation by the Tribal Water Administrator. All decisions of the Water Board shall be appealable directly and exclusively to the Tribal Courts.

- Summary: The Northern Cheyenne Water Code contains the provisions and guidelines to effectively manage the water resources of the reservation, however, with the fairly recent

approval of the Water Code, the Tribal Water Resources Board has not yet been established. Currently, no permitting process or accounting for water resources exists on the reservation. Once underway, the Water Code will empower the Tribe by enabling them to control and protect the water resources on the reservation.

- Northern Cheyenne Tribe Draft Surface Water Quality Standards: A water quality standard defines the water quality goals for a water body, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by protecting water quality through antidegradation provisions. The Tribe has adopted these standards to protect public health and welfare, enhance the quality of water, and serve the purposes of the Federal Clean Water Act. Currently, the Northern Cheyenne Tribe's Draft Surface Water Quality Standards have been submitted to the EPA and the public review process is near completion. In addition, the Tribe's application under Section 518 of the Clean Water Act for Treatment as a State for the purposes of implementing the Clean Water Act's water quality standards program is still pending before the EPA. The Tribe's Treatment as a State application and water quality standards are vital in the Tribe's water quality protection program and aid in evaluating potential impacts on water quality from a broad range of causes and sources.

- A primary purpose of the water quality standards is to guide efforts to monitor and assess surface water quality within the reservation. Any regulatory pollution controls established by the Tribe or the Federal Government must be developed to ensure a level of water quality that will satisfy these water quality standards. Surface water quality standards are adopted to establish maximum allowable levels or concentrations of pollutants and provide a basis for protecting water quality that is presently better than standards required for surface water quality. They serve to establish a basis for limiting the introduction of pollutants, which could affect existing or designated uses of reservation surface waters. The following surface water characteristics and policies are described in the Draft Water Quality Standards:

- Beneficial Uses: Beneficial use classifications are designated to all surface waters of the reservation in order to achieve national "fishable and swimmable" goals. Narrative water quality criteria and sampling methods are described along with the tribe's biological and radiological surface water standards.

- Antidegradation Policy: The tribe's antidegradation policy is consistent with the federal antidegradation policy found in EPA's water quality standards regulation. The purpose of the policy is to protect existing water quality where the quality of the water is better than required to support the designated uses.

- Mixing Zone and Dilution Policy: The mixing zone and dilution policy describes how dilution and mixing of point source discharges within receiving waters will be addressed in developing discharge limitations for point source discharges. Compliance requirements and 401 Certification procedures are also described. The requirements for standards implementation are outlined. Once approved and adopted by EPA, the Tribe's standards program will have the same legal standing as those adopted by states. The federal government will be responsible for the enforcement of the standards. EPA Region VIII will have the responsibility of enforcing requirements applicable to point source discharges, including those permit requirements that are based on the Tribe's water quality standards.

- SAR and EC. The Tribe is especially concerned about salinity and its impacts on riparian areas and irrigated lands. The Tribe has developed numeric criteria for the Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC) of waters of the reservation to address these concerns. The proposed numeric standards for EC and SAR are presented in Table 3-21. The rationale behind the numeric criteria for SAR is based on James Bauder's final report, "Recommended In-Stream Standards, Thresholds, and Criteria for Irrigation or Water Spreading to Soils of Alluvial Channels, Ephemeral Streams, Floodplains, and Potentially Irrigable Parcels of Land within the Boundaries of the Northern Cheyenne Reservation" (2001).

In response and consideration of comments, concerns, and objections received from various parties, modifications have been incorporated into the proposed surface water standards for EC and SAR of the Northern Cheyenne Reservation.

Table 3-21 shows revised numeric standards for EC and SAR and indicator values for TDS applicable to the mainstems of the Tongue River and Rosebud Creek and their tributaries.

TABLE 3-21
REVISED NUMERIC STANDARDS FOR EC AND SAR AND TDS INDICATOR VALUES

	Electrical[1] Conductivity (EC) dS/m	Sodium[2] Adsorption Ratio (SAR)	Total[3] Dissolved Solids (TDS) mg/l
Southern Boundary			
Irrigation period average[4]	1.0	--	660
Non-irrigation period average[5]	2.0	2.0	1,320
Northern Boundary			
Irrigation period average	1.5	--	990
Non-irrigation period average	2.0	3.0	1,320
Tributaries			
Irrigation period average	1.5	--	990
Non-irrigation period average	2.0	3.0	1,320

[1]The EC values are numerical water quality standards. EC is an expression of salinity as electrical conductance reported in deciSiemens per meter at 25 degrees C (dS/m) or in units of millimhos per centimeter (mmho/cm).

[2]The SAR values are numerical water quality standards. SAR is an expression of the concentration of sodium relative to the sum of concentrations of calcium and magnesium in water.

[3]The TDS values are indicator values and are not water quality standards. TDS is an expression of salinity as total dissolved solids in mg/L. The TDS values will be used to monitor conditions and trends in Tribal waters. If a TDS indicator value is exceeded, the tribe will evaluate the cause and, where appropriate, make necessary adjustments to the EC water quality standard(s). Any change to the EC standard will be made through the tribe's water quality standards-setting process.

[4]An irrigation period average is a 30-day average applicable during the period of active irrigation or water spreading, defined by the tribe as April 1 through November 15 annually.

[5]A non-irrigation period average is a 30-day average applicable during the non-irrigation season, November 16 through March 31 annually (Northern Cheyenne Tribe 2002).

Land Use and Realty

The Northern Cheyenne Reservation comprises approximately 2 percent of the land in the planning area. The Northern Cheyenne lands are used for cattle production, mining, logging and lumber production, residential, and recreation (Madison 2001). About 27,000 acres of reservation lands are presently under cultivation; the vast majority of this is dry-land farming, an additional 105,000 acres is composed of forested land that is considered commercially harvestable (U.S. Dept. of Commerce 1996).

The principal communities located on the Northern Cheyenne Reservation are as follows:

- Lame Deer—Lame Deer is located in Rosebud County approximately 21 miles west of Ashland between Busby and Custer National Forest along Highway 212/39. Lame Deer is the tribal headquarters and home of the Northern Cheyenne Powwow. There are approximately 1,925 Indian people residing in Lame Deer.
- Ashland—Ashland is located in Rosebud County 70 miles south of Miles City between Birney and Brandenburg along Highway 212 on the banks of the Tongue River near the Custer National Forest. Approximately 500 Indian people live in Ashland.

Recreation

The North Cheyenne Reservation also provides dispersed outdoor recreation activities for tribal members. Activities include hunting, fishing, hiking, horseback riding, and plant and berry gathering. Unrestricted hunting is limited to tribal members.

Developed recreation sites include Crazy Head Springs and Lost Leg Lake (fishing, camping, picnicking); Green Leaf, Red Nose, Parker, and LaFerre ponds (fishing); and Morning Star Lookout. Undeveloped sites include Buffalo Jump and Badger Peak.

Camping facilities exist at the Northern Cheyenne Craft Center in Lame Deer and at the Morning Star View Campgrounds. Tribal buffalo herds are pastured near Lame Deer Ice Well Campgrounds. A museum/curio shop is under development; this will serve, in part, as an outlet for the work of numerous tribal artists and craftspeople. The tribe holds a 4th of July powwow each year, which is widely attended. Finally, many visitors on their way to Glacier and Yellowstone parks, the Little Big Horn Battlefield, and other regional attractions find it convenient to stop by the reservation.

The only developed recreation area on the North Cheyenne Reservation is Crazy Head Springs. Picnic and camping facilities are available at the springs, which is used heavily. There are also several parks on the reservation including Birney Park, White Moon Park, Tongue River Park, Busby Park, and Lame Deer Park.

The North Cheyenne Reservation has lost recreational facilities in recent years with the closure of a swimming pool at Lame Deer Park and the loss of other park facilities with the opening of a new health center. A public gym was also removed to make room for a tribal government center.

Soils

Soils in the reservation, just like soils in the surrounding RMP area, are derived mainly from sedimentary bedrock and alluvium. The soils generally range from loams to clays, but are principally loams to silty clay loams. For more information on soil types, see the Soils Appendix.

Vegetation

The same types of vegetative communities as described in this chapter are anticipated to be found on the reservation. It is understood that the Northern Cheyenne Tribe considers certain plants to be sacred for their medicinal or traditional values.

The major native plant communities on Northern Cheyenne Lands include grass and shrub rangelands, forestlands, and riparian areas. These classifications are similar to those for the project area as a whole. These classifications are discussed in detail in the Vegetation section. Approximately 391,852 acres are classified as rangelands and 147,319 are classified as forestlands (Northern Cheyenne Tribe 2002). There are approximately 20,000 acres of riparian wetlands on Northern Cheyenne lands. Dominant species for these community types can be found under the Crow Reservation Vegetation section.

Special Status Species

The Northern Cheyenne have many sacred plants that are used for ceremonial and traditional uses. There are at least 170 plants with documented traditional or cultural uses (Northern Cheyenne Tribe 2002).

Wildlife

Wildlife habitat types and species occurring on the Cheyenne Reservation are also generally the same as those described for the CBM study area. Population

estimates are not available because of a lack of population survey data. However, the limited available data suggest that big game populations are far below what the habitat can support (Northern Cheyenne Tribe 2002). Mule and white-tailed deer populations have declined recently because of year-round hunting. As in other dry Western areas, riparian areas are the single most important wildlife habitat for many species. The riparian communities and mixed terrain of the Tongue River breaks have been identified as especially valuable wildlife habitat.

Sage grouse are widely distributed in suitable habitat. However, their numbers have declined on the reservation over the last 20 years. Black-tailed prairie dogs, black-footed ferrets, swift fox, mountain plovers, bald eagles, and peregrine falcon are species of concern found on the Northern Cheyenne Reservation (Northern Cheyenne Tribe 2002). With the exception of swift fox, these species of concern are considered under the Wildlife: Special Status Species section for the total project area. Swift fox (*Vulpes velox*) are one of the smallest foxes in the world and are only found in the Great Plains of North America. They were removed as a Candidate Species for Threatened Status by the USFWS on January 8, 2001. Their numbers are believed to be stable, but there is still concern for their future. They prefer short to mid-grass prairies, but they also sometimes inhabit mixed agricultural land (Egoscue 1979; Uresk and Sharps 1986).

The Northern Cheyenne Reservation is within that portion of the CBM-emphasis area associated with the Powder River RMP area. The Northern Cheyenne Tribe (2002) stated that the major streams of concern on the Northern Cheyenne Reservation are the Tongue River and Rosebud Creek. The Tribe reported that Rosebud Creek could support a game fish population if there were an assured flow and temperature control. The Tribe noted that Rosebud Creek is not suited for trout, but that it could support smallmouth bass—a species that prefers cool-water streams with clean bottoms and extensive riffles. Table WIL-2 summarizes aquatic resources characteristics and resource values from the Montana NRIS (2001) Internet data base for the upper Tongue River and Rosebud Creek.

The Northern Cheyenne Tribe (2002) reported there is a diversity of aquatic resources on the Northern Cheyenne Reservation, including some 32 different fish species. The Tribe, citing fisheries studies conducted in the vicinity of the reservation in 1973 (HKM 1973), stated that a reproducing population of smallmouth bass had been established in the Tongue River. Other important species of sport fish that were collected in the Tongue River include walleye, sauger, northern pike, and channel catfish. The Tribe also noted that the Tongue River is unique in supporting the only population of rock bass in Montana. Table WIL-3 in the Wildlife Appendix summarizes fish species composition and abundance information from the Montana NRIS (2001) Internet data base for the upper Tongue River and Rosebud Creek.

Paleontological Resources

Paleontologic resources consist of fossil-bearing rock formations containing information that can be interpreted to provide a further understanding about Montana's past. Fossil-bearing rock units underlie the entire planning area. While fossils are relatively rare in most rock layers, there are seven geologic rock units within the planning area that do contain significant fossil material. Rock units that are known to contain fossils are the Tullock and Ludlow Members of the Fort Union Formation, the Judith River, Hell Creek, Morrison, and Cloverly Formations, the Lakota Sandstone Formation, and the White River Group. Figure 3-1 is a stratigraphic section showing the age and relative position of each of these fossil-bearing units.

The Morrison, Hell Creek, Cloverly, and Lakota Sandstone formations are noted for the occurrence of dinosaur fossils. The Bridger Fossil ACEC, a 575-acre site located in Carbon County within the Billings RMP area, contains outcrops of both the Cretaceous Period Cloverly Formation and the Jurassic Period Morrison Formation. Outcrops of the Morrison Formation within the Bridger Fossil area have yielded the fossil remains of numerous juvenile and subadult sauropods. The Bridger Fossil Area is one of two listed National Natural Landmarks within the Billings RMP area, the other is the Cloverly Formation site in Bighorn County (Federal Register 48(41):8693 1983). There are other areas within the EIS study areas that have been nominated for National Natural Landmarks for paleontological resources.

The Judith River Formation preserves the fossil record from ancient environments including shallow oceans, deltas, rivers, freshwater swamps, and lakes. The Judith River Formation contains the fossil remains of plants as well as many animal species including mollusks, fish, amphibians, lizards, small mammals, dinosaurs, and other reptiles.

The Cretaceous Period Hell Creek Formation preserves the fossil record of a subtropical to tropical environment that was characterized by low plains interrupted by broad swampy bottoms and deltaic areas. Fossil remains from the Hell Creek Formation include a wide variety of plants, mollusks, fish, amphibians, reptiles, birds, small mammals, and dinosaurs. Fossil dinosaur remains include *Triceratops, Anatosaurus,* and *Tyrannosaurus.* The fossil record of plant and animal communities found within the Hell Creek Formation varies between low moist areas and the drier, upland plains environments that were present in the past. The Castle Butte ACEC, located in Yellowstone County within the Billings RMP area, contains outcrops of the Hell Creek Formation, which are noted for their paleontologic resources.

The contact between the Cretaceous Period Hell Creek Formation and the Paleocene Tullock/Ludlow Member of the Fort Union Formation marks an important event in time. This contact represents a time of worldwide extinction for many animals, most notably the dinosaurs, and the beginning of the rapid evolution of mammals. The fossil record from the Fort Union Formation contains evidence of ancient environments that include streamside swamps, bottomlands, and well-established river courses. Fill within ancient river channels contains fossils of fresh water clams and snails. The Tullock/Ludlow Member is the primary fossil-bearing unit of the Fort Union Formation and contains fossils of turtles, fish, reptiles, and mammals.

The Tertiary Period White River Group is considered an important source of fossil mammals. Although the White River Group outcrops in the planning areas, the majority of the fossil-bearing areas are in the Dakotas.

Recreation

Montana's natural features, coupled with the large amount of state and federal lands, offer residents and vacationers a variety of year-round recreational opportunities. Montana has thousands of miles of streams, hundreds of lakes, reservoirs, mountainous areas, rolling hills, and grassland prairies—many of which are available for recreational purposes.

The planning area, which includes the Billings and Powder River RMP areas and the counties of Blaine, Gallatin, and Park, are replete with recreational opportunities that vary with seasonal changes. Spring and summer provide opportunities for fishing, hiking, photography, wildlife viewing, spring turkey hunting, water sports (powered and non-powered), off-road vehicle activities, camping, picnicking, touring (vehicle and bicycle), and caving. Early to late fall is hunting season. Winter brings the winter sports of skiing, snowshoeing, and snowmobiling. The planning area provides vast areas for people to enjoy.

Federal

There are three national forests in the planning area: Custer, Gallatin, and Lewis and Clark. These forests provide a variety of yearlong, outdoor recreation. The Absaroka Beartooth Wilderness and the Lee Metcalf Wilderness (Spanish Peak Unit) in the Gallatin National Forest provide unique wilderness opportunities for hiking, horseback riding, camping, fishing, hunting, wildlife viewing, and photography. The Bridger Mountains National Recreational Trail (also in the Gallatin Forest), the Lewis and Clark Historic Trail, and the Nez Perce National Historic Trail provide opportunities for hiking, photography, wildlife viewing, and historic touring.

The Upper Missouri National Wild and Scenic River and the Missouri Breaks National Monument (North Side–Blaine County) provides fishing, hiking, non-powered water sports, camping, picnicking, wildlife viewing, and photography opportunities.

The Bighorn Canyon National Recreation Area is a popular area for camping, fishing, boating, hiking, wildlife viewing, and photography. West of and adjacent to the Bighorn Canyon National Recreation Area is the Pryor Mountain Wild Horse Range where off-road vehicles are not allowed, and skiing, caving, hiking, and wildlife viewing occur.

The BLM has land holdings throughout the state. The majority of this land is not contiguous; it is fragmented and many times isolated by private holdings. Most of this land is managed for multiple use. Recreational opportunities include hiking, horseback riding, off-road vehicle travel, fishing, hunting, wildlife viewing, camping, picnicking, caving, skiing, and showshoeing. The off-road vehicle plan is currently under protest. If approved, off-road vehicle use would be limited. Included in this land are the Pryor Mountain Wild Horse Range and the Pompey's Pillar National Monument.

There are nine National Wildlife Refuges in the planning area—two in Blaine County, one in Golden Valley County, four in Musselshell County, and two in Stillwater County. They provide opportunities for wildlife viewing, hiking, and photography.

According to 33 CFR Part 329, navigable waters of the U.S. are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the water body, and is not extinguished by later actions or events that impede or destroy navigable capacity. A determination whether a water body in the project area is a navigable water of the U.S. is made by the U.S. Army Corps of Engineers Omaha District's Division Engineer, and is based on a report of findings prepared at the district level in accordance with the criteria set out in regulations. Tabulated lists of final determinations of navigability are maintained in the District office, and are updated as necessitated by court decisions, jurisdictional inquiries, or other changed conditions.

State

There are 12 state parks within the emphasis area that offer outdoor activities, Native American history and geological sites, wildlife preserves, water sports, photography, hiking, camping, and fishing. These parks are Chief Plenty Coups, Cooney Reservoir, Greycliff Prairie Dog Town, Lake Elmo, Madison Buffalo Jump, Medicine Rocks, Missouri Headwaters, Natural Bridge, Pictograph Cave, Rosebud Battlefield, and Tongue River Reservoir.

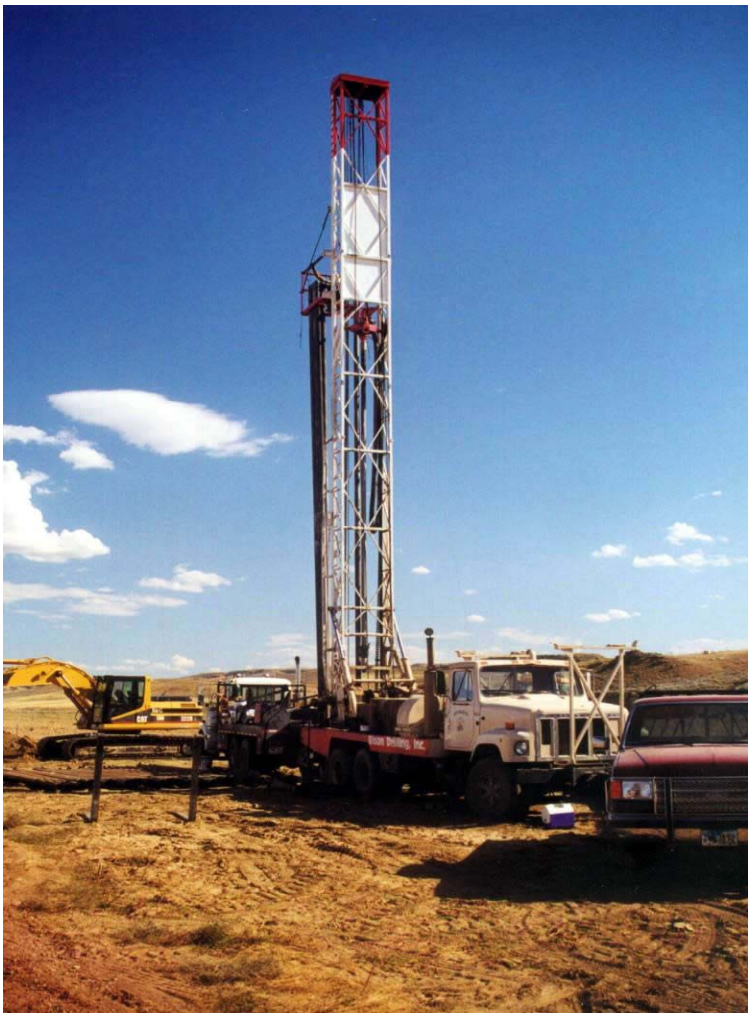
In addition, state-owned lands checkerboard the planning areas. Much of this land is surrounded by private or federal land. Recreational opportunities include hunting, fishing, wildlife viewing, hiking, snowmobiling, and skiing. Navigable waterways and islands owned by the state also provide additional recreational opportunities.

Local/City Recreation

The larger municipalities of Billings, Bozeman, Laurel, Miles City, Livingston, and Three Forks offer museums, parks, baseball fields, rodeo grounds/fairgrounds, walking/hiking/bike trails, water sports, and other opportunities. The other municipalities in the planning area offer a city park, outdoor sports activities at the schools, and, depending on the municipality, possibly a museum or rodeo grounds.

Private Lands

In addition to public lands, recreational opportunities also exist on privately owned lands, including private campgrounds, resorts, and dude ranches. Activities such as hunting and backcountry trips also may be permitted on privately owned land with landowner consent. Recreational opportunities also arise on private lands as a result of Montana Fish, Wildlife, and Parks (MFWP) actions, such as hunting opportunities through the block management program and conservation easements.



Typical rig used to drill a CBM well

Social and Economic Values

This section examines social, economic and environmental justice information for the 16 counties in the CBM emphasis area. The three counties with the most potential CBM wells are Big Horn, Powder River and Rosebud counties. These counties are located adjacent to each other in southeastern Montana (see Map 1-1). The Northern Cheyenne Reservation is located predominantly in Big Horn County. Information on these reservations is located in this section as well as the sections entitled **Indian Trust Assets** and **Native Americans** in this chapter.

Demographics

Population data for Montana and the 16-county CBM emphasis area is presented in Table 3-22. Between 1990 and 2000, the population in Montana increased at an average annual rate of 1.2 percent to 902,195 persons. The 16-county planning area grew at a slightly greater rate of 1.5 percent over the same period. Three counties—Gallatin, Stillwater, and Carbon—grew faster than the average for the planning area, with average annual rates of 3.0 percent, 2.3 percent, and 1.7 percent, respectively. Four counties—Carter, Powder River, Rosebud, and Treasure—had negative growth rates and lost population.

TABLE 3-22
HISTORICAL POPULATION AND POPULATION FORECASTS

	1990 (Census)	2000 (Census)	Percent Annual Average Growth 1990-2000	2020 (Forecast)	Percent Average Annual Growth 2000-2020
Big Horn County	11,337	12,671	1.1%	14,880	1.6%
Blaine County	6,728	7,009	0.4%	7,310	0.4%
Carbon County	8,080	9,552	1.7%	11,390	1.8%
Carter County	1,503	1,360	-1.0%	1,470	0.8%
Custer County	11,697	11,696	0.0%	13,060	1.1%
Gallatin County	50,463	67,831	3.0%	82,460	2.0%
Golden Valley County	912	1,042	1.3%	1,180	1.3%
Musselshell County	4,106	4,497	0.9%	5,390	1.8%
Park County	14,484	15,694	0.8%	20,170	2.5%
Powder River County	2,090	1,858	-1.2%	1,770	-0.5%
Rosebud County	10,505	9,383	-1.1%	13,720	3.9%
Stillwater County	6,536	8,195	2.3%	10,590	2.6%
Sweetgrass County	3,154	3,609	1.4%	3,870	0.7%
Treasure County	874	861	-0.1%	800	-0.7%
Wheatland County	2,246	2,259	0.1%	2,330	0.3%
Yellowstone County	113,419	129,352	1.3%	158,310	2.0%
Total Emphasis Area	**248,134**	**286,869**	**1.5%**	**348,700**	**2.0%**
State of Montana	**799,065**	**902,195**	**1.2%**	**1,082,260**	**1.8%**

Source: Montana Department of Commerce, 2001. Census and Economic Information Center. Projections by NPA Data Services, Inc.

The forecasted population for the year 2020 is also shown in Table 3-22. For both the state and the CBM emphasis area, the forecasts show faster growth over the next 20 years compared to the last 10 years. State population is forecast to grow by 1.8 percent and the planning area is forecast to grow by 2.0 percent. Four counties—Gallatin, Park, Rosebud, and Stillwater—are projected to grow at equal or greater rates than the average for the emphasis area, with rates of 2.0 percent, 2.5 percent, 3.9 percent, and 2.6 percent, respectively. Population in Treasure County is forecast to fall, with a rate of –0.7 percent. However, personal communication with the Montana Department of Labor and Industry indicates that the projected population of 13,720 for Rosebud County in the year 2020 is an overestimate and that a more likely future population is 12,200 or 12,500 (Montana Department of Labor and Industry 2001b). These numbers correspond to annual growth rates of 1.3 percent and 1.4 percent, respectively, which are more consistent with the average for the emphasis area and the state.

Data on race and ethnicity from the 2000 U.S. Census are shown in Table 3-23. The data indicate that the Montana population is 90.6 percent white, similar to the 16-county planning area, which is 90.1 percent white. Statewide and in the planning area, Native Americans make up the largest non-white group, totaling 6.2 percent and 6.6 percent, respectively. Persons identified as Hispanic or Latino (of any race) compose 2.0 percent of the state population and 2.6 percent of the 16-county area population.

While 13 of the 16 counties are between 92.8 percent and 99.1 percent white, three of the counties—Big Horn, Blaine, and Rosebud—include Indian reservations with substantial Native American populations. Big Horn County, which includes most of the Crow Reservation and part of the Northern Cheyenne Reservation, has a population that is 59.7 percent Native American. Rosebud County also includes part of the Northern Cheyenne Reservation and is 32.4 percent Native American. Blaine County includes most of the Fort Belknap Reservation and is 45.4 percent Native American.

TABLE 3-23
RACE/ETHNICITY AS PERCENT OF TOTAL POPULATION

Geographic Area	Total Population	Percent White	Percent Black or African American	Percent American Indian and Alaska Native	Percent Asian	Percent Native Hawaiian and Other Pacific Islander	Percent Some Other Race	Two or More Races	Percent Hispanic or Latino (of any race)[1]
Big Horn County	12,671	36.6%	0.0%	59.7%	0.2%	0.0%	0.7%	2.8%	3.7%
Blaine County	7,009	52.6%	0.2%	45.4%	0.1%	0.0%	0.2%	1.5%	1.0%
Carbon County	9,552	97.1%	0.3%	0.7%	0.4%	0.0%	0.6%	1.0%	1.8%
Carter County	1,360	98.6%	0.1%	0.4%	0.1%	0.0%	0.3%	0.5%	0.6%
Custer County	11,696	97.0%	0.1%	1.3%	0.3%	0.1%	0.3%	1.0%	1.5%
Gallatin County	67,831	96.2%	0.2%	0.9%	0.9%	0.1%	0.5%	1.2%	1.5%
Golden Valley County	1,042	99.1%	0.0%	0.6%	0.1%	0.0%	0.0%	0.2%	1.2%

TABLE 3-23
RACE/ETHNICITY AS PERCENT OF TOTAL POPULATION

Geographic Area	Total Population	Percent White	Percent Black or African American	Percent American Indian and Alaska Native	Percent Asian	Percent Native Hawaiian and Other Pacific Islander	Percent Some Other Race	Two or More Races	Percent Hispanic or Latino (of any race)[1]
Musselshell County	4,497	96.9%	0.1%	1.3%	0.2%	0.0%	0.4%	1.2%	1.6%
Park County	15,694	96.6%	0.4%	0.9%	0.4%	0.0%	0.5%	1.2%	1.8%
Powder River County	1,858	97.4%	0.0%	1.8%	0.1%	0.0%	0.2%	0.5%	0.6%
Rosebud County	9,383	64.4%	0.2%	32.4%	0.3%	0.0%	0.7%	2.0%	2.3%
Stillwater County	8,195	96.8%	0.1%	0.7%	0.2%	0.0%	0.9%	1.2%	2.0%
Sweet Grass County	3,609	97.0%	0.1%	0.6%	0.3%	0.0%	0.7%	1.3%	1.5%
Treasure County	861	96.4%	0.1%	1.6%	0.3%	0.0%	0.9%	0.6%	1.5%
Wheatland County	2,259	97.0%	0.1%	0.6%	0.2%	0.2%	0.3%	1.6%	1.1%
Yellowstone County	129,352	92.8%	0.4%	3.1%	0.5%	0.0%	1.3%	1.9%	3.7%
Planning Area Total	286,869	90.1%	0.3%	6.6%	0.5%	0.0%	0.9%	1.6%	2.6%
MONTANA	902,195	90.6%	0.3%	6.2%	0.5%	0.1%	0.6%	1.7%	2.0%

Source: U.S. Census Bureau, Census 2001a Redistricting Data (Public Law 94-171) Summary File, Matrices PL1 and PL2.
[1]Percent numbers in this column are a subset of one or more of the other race/ethnicity designation percentages.

Table 3-24 shows the percentage of people below the poverty level (as defined by the U.S. Census Bureau) for Montana and each of the 16 study-area counties (1997 data). The Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is poor. Compared to the state as a whole, the 16-county planning area has a somewhat greater percentage of people below the poverty level; some counties within the planning area have poverty rates that are much higher than average for the state.

In 1997, the percentage of the population of Montana below the U.S. Census Bureau poverty threshold was 15.5 percent; the average in the 16-county emphasis area was 17.3 percent. Nine of the 16 counties in the planning area have poverty rates greater than the state average. The two counties with the highest rate are Big Horn and Blaine, where more than one quarter of the population had an income below the poverty level in 1997. The total number of persons in the planning area below the poverty level was about 39,093. This represents about 28.8 percent of the state's total population below the poverty level.

Table 3-14 in the Native Americans section of Chapter 3 shows the percent of tribal members who are

employed but below U.S. Health and Human Services poverty guidelines (similar to U.S. Census guidelines). These data indicate that the percent of tribal members who are employed but below the poverty guideline is greater than the total percent of persons below poverty for the respective counties where the tribes are located. It can be inferred that the total poverty rate for all tribal members (employed and unemployed) would be even greater than just for those who are employed, suggesting relatively large numbers of persons on the reservations living in poverty.

The three counties with the most potential CBM wells, Big Horn, Powder River and Rosebud counties, have a combined 2000 population of 24,000, which is less than 10% of the total population of the emphasis area. Two of these counties, Powder River and Rosebud, lost population during the previous decade (both lost 11%), while Big Horn County grew 12% during the same time period. Big Horn and Rosebud counties are forecasted to grow 17% and 30%, respectively, between the years of 2000 and 2020. Powder River County, with its population of 1,858, is projected to continue to slowly lose population between 2000 and 2020. The county seats are in Hardin in Big Horn County with a 2000 population of 3,384, Broadus in Powder River County with a 2000 population of 451, and Forsyth in Rosebud County with a 2000 population of 1,944. There are numerous small reservation communities located in Big Horn and Rosebud counties. In 1990, Big Horn County, which includes most of the Crow Reservation and part of the Northern Cheyenne Reservation, had a population that was nearly 60% Native American. Rosebud County, which includes most of the Northern Cheyenne Reservation had a 2000 population that was 32% Native American. The 1997 poverty rates for Big Horn, Powder River and Rosebud counties were 29.6%, 15.3% and 19.9%, respectively. These rates reflect the relatively large numbers of persons on the reservations living in poverty. For additional information on demographics for the Northern Cheyenne and Crow Tribes see Social and Economic Values in the Native Americans section of this Chapter.

TABLE 3-24
POVERTY STATUS BY COUNTY (AS DEFINED BY U.S. CENSUS BUREAU)
(1997)

	Number of Persons Below Poverty Level	Percent of Population Below Poverty
Big Horn County	3,768	29.6%
Blaine County	1,904	26.8%
Carbon County	1,230	12.9%
Carter County	294	19.3%
Custer County	2,022	17.0%
Gallatin County	7,059	11.6%
Golden Valley County	216	21.2%
Musselshell County	893	19.4%
Park County	2,196	13.8%
Powder River County	277	15.3%
Rosebud County	1,999	19.9%
Stillwater County	860	10.6%
Sweetgrass County	418	12.3%
Treasure County	141	15.8%
Wheatland County	453	19.8%
Yellowstone County	15,363	12.1%
Planning Area Total	**39,093**	**17.3%**
Montana	**135,691**	**15.5%**

Source: U.S. Census Bureau Small Area Income and Poverty Estimates Program 2001b.

Social Organization

Housing Units and Vacancy

Housing units and vacancy rates for Montana and the 16-county planning area are shown in Table 3-25. The latest available county-specific data on housing units is from the 2000 Census (U.S. Census Bureau 2001). Although the vacancy rates reported here illustrate the averages in the counties in the planning area, sub-county variations may exist as a result of factors such as high population growth in a portion of the county.

In 2000, Montana had 412,633 housing units, 12,635 or 31 percent of these were in the 16-county planning area. Eight percent (9,874) of the planning area housing units were located in Big Horn, Rosebud and Powder River counties.

Homeowner vacancy rates indicate the percent of total owner-occupied housing that is vacant. In Montana, the homeowner vacancy rate for 2000 was 2.2 percent, compared to 3.4 percent for the planning area. Four counties had home ownership vacancy rates higher than the planning area average, suggesting a surplus of vacant houses on the market. The three counties with the most potential for CBM wells, Big Horn, Powder River and Rosebud, all had lower homeowner vacancy rates than the planning area average. Housing availability on the Northern Cheyenne and Crow Reservations is discussed under Social Organization in the Native Americans section of this chapter.

The rental vacancy rate in 2000 was 7.6 percent for the state and 9.0 percent for the planning area. Generally, rental vacancy rates between 5 percent and 10 percent are considered adequate. Rental vacancy rates below 5 percent can indicate potential rental shortages and above 10 percent can indicate potential surplus. The rental vacancy rates for the three counties with the most potential for CBM wells, Big Horn, Powder River and Rosebud, were 6.3, 13.1 and 11.7, respectively.

Temporary Housing

Temporary housing units are typically defined to include hotels and motels, and recreational vehicle or camping sites. An inventory of temporary housing units is typically included in an environmental impacts analysis to use in determining potential impacts on the local housing supply from an influx of temporary population (such as construction workers or other employees). This data is typically gathered for a city, county, or small region. Because of the broad scope of this study, however, an inventory of accommodations by specific location was not attempted. A large number of hotels/motels and recreational vehicle and camping areas are available throughout the state and the 16-county planning area. These sites tend to be concentrated in and around the large cities, such as Billings or Bozeman, as well as major tourist or recreation areas, such as Yellowstone National Park. They are less likely to be available in the three counties with the most potential for CBM wells.

Public Services and Utilities

Public services, typically provided by local governments (cities, counties, and special service districts), include police and fire protection, emergency medical services, schools, public housing, parks and recreation facilities, water supply, sewage and solid waste disposal, libraries, and roads and other transportation infrastructure. Other important community services include electric and communications utilities. The provision of public services and the ability of service providers to adapt to change over time, or resulting from specific development activities, depend on a number of factors, including financial ability and community leadership. Public services are generally funded by tax revenues, although there may be other sources of revenue such as user fees or utility franchise fees. The tax base of the county or community where public services are provided is often a key component of the funding of public services. Information on public services and facilities for the Northern Cheyenne and Crow Reservations is presented under Social Organization in the Native American section of this chapter.

TABLE 3-25
HOUSING UNITS

	2000 Housing Units	2000 Homeowner Vacancy Rate (%)	2000 Rental Vacancy Rate (%)
Big Horn County	4,655	2.2	6.3
Blaine County	2,947	2.7	7.6
Carbon County	5,494	3.0	8.1
Carter County	811	6.9	8.1
Custer County	5,360	2.6	11.6
Gallatin County	29,489	1.8	5.7
Golden Valley County	450	6.3	8.8
Musselshell County	2,317	6.8	8.4
Park County	8,247	2.3	7.4
Powder River County	1,007	3.0	13.1
Rosebud County	3,912	1.9	11.7
Stillwater County	3,947	2.7	6.1
Sweetgrass County	1,860	2.1	10.3
Treasure County	422	2.3	6.4
Wheatland County	1,154	6.4	18.2
Yellowstone County	54,563	1.2	5.4
Planning Area Total	**126,635**	**3.4%**	**9.0%**
Montana	**412,633**	**2.2%**	**7.6%**

Source: U.S. Census Bureau 2001

Attitudes, Beliefs, Lifestyles, and Values

Information on general attitudes, beliefs, lifestyles, and values in Montana and the general planning area as they relate to CBM development has been gathered from public comment letters received during the scoping process for this project and also from past summaries in several related documents. While the generalized characterizations are not likely to apply to all individuals, the intention is to provide an idea of the range of the attitudes and lifestyles of the population subgroups present in the study area. See the Socioeconomics Appendix for detailed information.

The study area population is largely rural, with strong ties to the land and to the many small towns. Residents generally value the rural character of their lifestyle. Specific aspects of this lifestyle might include appreciation of wide-open spaces, natural landscape, fresh air, and solitude. The lifestyle of rural communities often offers the desirable qualities of neighbors knowing each other, lack of urban problems, relaxed pace, personal freedom, and being a good place to raise children. Longtime residents often want to see continued control of the land at the local level without interference from outside agencies or groups.

A portion of the population in the study area are Native Americans, who generally desire to preserve many elements of their heritage, express strong connections

with the natural environment, and often do not wish to become homogenized into the non-Indian culture. At the same time, some tribal members or subgroups are pursuing the development of energy resources for the long-term social and economic betterment of tribal members.

A small but growing population is made up of professionals, craftspeople, retirees, and others who have moved to small towns to enjoy the slower pace of life and various amenities. While the forested areas of western Montana tend to attract more of this group than eastern Montana, these people are present in the study area as well. They may participate in opposition to development proposals that appear to jeopardize the quality of their new lifestyles.

Areas where energy resources are developed often see the influx of people from other areas. Many of these people regard their employment as temporary, expect to move on to other areas, and do not play an integral part in community affairs. Long-term local residents often resent these "outsiders" while at the same time realizing some economic benefits from the business and service demands of these newcomers.

The vast majority of public comments received during the scoping process in early 2001 relayed concerns about potential impacts on water quality and quantity. Those who commented were most concerned with the discharge of water of poor quality (e.g., saline) and the drawdown of groundwater aquifers. Other concerns include possible increases in traffic levels, noise, visual resource impacts, and psychological stress associated with change to the surrounding built and natural environment.

The comments reflect a difference in attitudes toward CBM development among those individuals and organizations that might profit directly from CBM and those that would not. The comments reflect a tension between the desire for new development to support the often stagnant rural economies and the concern that such development could harm the environment and the lifestyle qualities for which Montana is known, including natural beauty, wide-open spaces, and solitude. Concerns were also expressed about potential adverse affects on the lifestyles of Native Americans, particularly those on the reservations. The comments reflect the traditional high value placed on natural resources by these groups, the importance of existing water and other natural resources in tribal economies and cultures, and the opinion that tribal members will be unduly burdened with the costs of development while not receiving many or any benefits.

Economics

Employment

Table 3-26 displays state employment by sector for the years 1990 and 1998. In 1998, an estimated 543,333 people were employed in Montana, with 184,525 in the 16-county planning area. In 1998, employment in the planning area represented about 34 percent of the jobs in the state. Between 1990 and 1998, total employment in the state grew by 106,759, an increase of 24.5 percent. Employment in the 16 study-area counties grew by a total of 39,008, or 26.8 percent, during the same period.

Montana's largest employment sectors in 1998 were services, retail trade, and government; the smallest sector was mining. By far the fastest-growing sector between 1990 and 1998 was construction, which increased by 74.3 percent during the period. Other fast-growing sectors were agriculture, forestry and fishing services, and retail trade.

Some sectors of state employment decreased between 1990 and 1998. Mining jobs decreased by 14 percent in the state, from 7,824 to 6,730. Overall, government jobs increased by only 3.4 percent; within that sector, military jobs decreased by 19.4 percent and federal civilian jobs decreased by 8.2 percent.

Tables 3-27 and 3-28 present state and planning area employment by sector. Table 3-27 shows that the economic base of the planning area by sector is very similar to the state as a whole. However, as indicated in Table 3-28, there is substantial variation among the sizes and strengths of the various economic sectors in the 16 study-area counties.

TABLE 3-26
MONTANA EMPLOYMENT TRENDS BY SECTOR

	1990	1998	Change, 1990-1998	Percentage Point Change, 1990-1998
Farm Employment	30,576	32,071	1,495	4.9%
Non-Farm Employment				
Agriculture, Forestry, Fishing, and other	6,154	8,739	2,585	42.0%
Mining	7,824	6,730	-1,094	-14.0%
Construction	19,070	33,245	14,175	74.3%
Manufacturing	26,342	29,504	3,162	12.0%
Transportation and Public Utilities	23,858	26,759	2,901	12.2%
Wholesale Trade	17,449	20,693	3,244	18.6%
Retail Trade	78,715	106,202	27,487	34.9%
Finance, Insurance, and Real Estate	27,693	34,673	6,980	25.2%
Services	118,623	161,740	43,117	36.3%
Government				
Federal, Civilian	13,771	12,647	-1,124	-8.2%
Military	10,516	8,474	-2,042	-19.4%
State	21,561	22,972	1,411	6.5%
Local	34,422	38,884	4,462	13.0%
Montana Total	**436,574**	**543,333**	**106,759**	**24.5%**

Source: U.S. Department of Commerce, BEA 2001.

TABLE 3-27
STATE EMPLOYMENT VERSUS PLANNING AREA EMPLOYMENT BY SECTOR (1998)

	Planning Area Employment by Sector	% of Planning Area Total by Sector	State Employment by Sector	% of State Total by Sector
Farm Employment	9,459	5.2%	32,071	5.9%
Non-Farm Employment				
Agriculture, Forestry, Fishing, and other	2,347	1.3%	8,739	1.6%
Mining	2,193	1.2%	6,730	1.2%
Construction	11,590	6.3%	33,245	6.1%
Manufacturing	8,583	4.7%	29,504	5.4%
Transportation and Public Utilities	8,450	4.6%	26,759	4.9%
Wholesale Trade	9,287	5.1%	20,693	3.8%
Retail Trade	36,475	20.0%	106,202	19.5%
Finance, Insurance, and Real Estate	11,789	6.5%	34,673	6.4%
Services	54,915	30.1%	161,740	29.8%
Government				
Federal, Civilian	3,730	2.0%	12,647	2.3%
Military	1,596	0.9%	8,474	1.6%
State	7,390	4.0%	22,972	4.2%
Local	12,137	6.6%	38,884	7.2%
Undisclosed or under 10 jobs	2,586	1.4%	N/A	N/A
Montana Total	182,527	100.0%	543,333	100.0%

Source: U.S. Department of Commerce, BEA 2001.

TABLE 3-28
PLANNING AREA EMPLOYMENT BY COUNTY AND SECTOR (1998)

Industry	Big Horn	Blaine	Carbon	Carter	Custer	Gallatin	Golden Valley	Musselshell	Park	Powder River	Rosebud	Stillwater	Sweet Grass	Treasure	Wheatland	Yellowstone
Farm Employment	13.2%	21.8%	17.9%	44.4%	6.9%	2.5%	41.7%	15.8%	6.8%	33.8%	9.7%	14.3%	22.4%	40.6%	22.1%	1.6%
Non-Farm Employment																
Agriculture, Forestry, Fishing, and other	3.0%	a	3.1%	a	1.5%	1.6%	a	a	1.7%	a	1.4%	2.5%	a	a	a	0.9%
Mining	8.7%	a	1.2%	a	b	0.4%	0.0%	3.6%	0.4%	1.7%	9.2%	a	b	0.0%	b	0.9%
Construction	3.3%	3.6%	6.8%	a	a	8.6%	a	6.5%	7.3%	a	1.5%	5.1%	9.0%	a	a	6.4%
Manufacturing	1.2%	1.2%	3.4%	1.9%	2.6%	6.4%	a	5.8%	6.3%	a	2.5%	8.9%	4.2%	0.0%	3.3%	4.3%
Transportation and public utilities	1.8%	2.2%	2.2%	3.6%	a	3.3%	b	4.3%	4.2%	5.0%	12.0%	a	a	5.7%	2.7%	6.1%
Wholesale trade	1.5%	3.6%	2.0%	0.0%	3.0%	4.0%	a	a	1.8%	1.0%	0.1%	1.6%	2.1%	a	a	7.6%
Retail trade	12.6%	14.6%	18.6%	8.0%	22.6%	21.0%	a	17.6%	21.4%	13.1%	12.3%	14.5%	20.5%	12.2%	20.5%	21.1%
Finance, Insurance, and Real Estate	3.7%	4.7%	5.9%	2.2%	5.9%	6.3%	0.0%	4.4%	5.8%	1.7%	3.3%	3.8%	5.4%	a	3.9%	7.5%
Services	30.3%	20.0%	27.0%	a	29.5%	28.5%	a	23.9%	34.7%	15.4%	34.0%	17.8%	16.3%	11.7%	22.5%	32.8%
Government																
Federal, Civilian	7.3%	6.4%	1.4%	2.0%	4.7%	1.1%	b	0.8%	0.9%	1.4%	3.2%	0.8%	1.5%	1.1%	3.6%	2.0%
Military	1.2%	1.3%	1.1%	1.0%	1.0%	0.8%	b	1.3%	1.0%	0.8%	1.0%	1.0%	0.9%	0.9%	1.1%	0.8%
State	0.8%	0.8%	0.5%	0.3%	4.1%	11.0%	b	0.8%	0.6%	1.7%	0.6%	0.5%	0.8%	1.4%	0.7%	1.9%
Local	11.4%	15.2%	8.9%	12.6%	7.7%	4.6%	16.3%	10.8%	7.0%	16.5%	9.3%	8.4%	12.2%	17.0%	12.7%	6.0%
Undisclosed or under 10 jobs	0	4.4%	0	24.0%	10.4%	0	41.9%	4.2%	0	7.8%	0	20.9%	4.6%	9.4%	6.8%	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: U.S. Department of Commerce, BEA 2001.
a = Not shown to avoid disclosure of confidential information but the estimates for these items are included in the totals.
b = Less than 10 jobs but the estimates for these items are included in the totals.

Unemployment

Table 3-29 presents the unemployment rate for Montana and each of the planning area counties in 1995 and 2000. In 1995, the average unemployment rates in Montana and in the planning area were essentially the same; 5.9 percent for the state and 5.8 percent for the planning area. In 2000, the average State unemployment rate had dropped to 4.9 percent while the average rate in the planning area remained at 5.8 percent.

In 2000, unemployment rates in four of the planning area counties were higher than the 16-county average: Big Horn (14.4 percent); Blaine (6.7 percent); Musselshell (7.4 percent); and Rosebud (7.5 percent). Unemployment rates in each of the counties but Musselshell are explained in part by the high unemployment rates on the Indian reservations contained wholly or partly within these counties. As indicated in Table 3-15 (in the Native Americans section of Chapter 3), unemployment on the Crow, Northern Cheyenne, and Fort Belknap Indian reservations in 1999 ranged between 14.9 percent and 22.9 percent. Consistent with trends in the rest of the state, the unemployment rate on each reservation fell between 1996 and 1999.

TABLE 3-29
AVERAGE ANNUAL UNEMPLOYMENT RATES BY COUNTY

	1995 Rate (%)	2000 Rate (%)	Percentage Point Change, 1995-2000
Big Horn County	12.7	14.4	1.7
Blaine County	9.8	6.7	-3.1
Carbon County	6.0	5.1	-0.9
Carter County	1.8	2.1	0.3
Custer County	4.6	4.3	-0.3
Gallatin County	2.7	2.7	0.0
Golden Valley County	7.6	5.7	-1.9
Musselshell County	8.6	7.4	-1.2
Park County	4.7	5.3	0.6
Powder River County	2.4	3.0	0.6
Rosebud County	9.2	7.5	-1.7
Stillwater County	5.0	4.9	-0.1
Sweetgrass County	3.7	2.5	-1.2
Treasure County	3.5	5.0	1.5
Wheatland County	5.1	4.6	-0.5
Yellowstone County	4.8	3.8	-1.0
Planning Area Total	**5.8**	**5.8**	**0.0**
Montana	**5.9**	**4.9**	**-1.0**

Source: Montana Department of Labor & Industry, Research & Analysis Bureau, Local Area Unemployment Statistics (2001a)

Unemployment rates on the reservations as measured by the Bureau of Indian Affairs are reported in Table 3-30. These rates are based on self-reported information from tribal leaders; 1999 is the latest year available. The rates calculated in this manner are substantially greater than those reported by the Montana Department of Labor and Industry (Table 3-30). They indicate unemployment at 61 percent for the Crow tribe, 71 percent for the Northern Cheyenne tribe, and 76 percent for the Fort Belknap tribe. For all tribal members in Montana, the unemployment rate was 61 percent.

Per Capita Income

Per capita income for the State of Montana and the counties in the planning area is shown in Table 3-31. In 1998, the average U.S. per capita income was $27,203, and the State average was $21,229. The average per capita income in the planning area was $17,715, only 83.4 percent of the state average. In 1998, per capita income in Gallatin and Yellowstone counties was higher than the State average, and incomes in Carbon, Custer, and Stillwater counties were more than 90 percent of the state average. On the other hand, per capita income in three counties was substantially lower: Big Horn County (62.4 percent); Carter County (61.9 percent), and Musselshell County (67.6 percent).

Between 1996 and 1998, per capita income in the planning area increased by an average of 5 percent annually, slightly greater than in the state as a whole, in which per capita income increased by 4.7 percent. Per capita income increased in all of the planning area counties between 1996 and 1998.

Government Revenue Sources

Government revenues include taxes, royalties, fees, and several other income sources. Please see the Socioeconomics Appendix for more information.

Taxes

Public finance mechanisms include taxes, royalties, and other fees paid to local, state, and federal governments. Taxes in Montana consist of property taxes, income taxes, natural resource taxes (coal, oil, and natural gas), and selective sales taxes (cigarette and alcoholic beverages). There is no general sales tax in Montana. Table 3-32 shows total taxes collected in Montana. In 2000, more than $789 million was collected in property taxes, accounting for 51.2 percent of the total state tax revenues collected. Income taxes were the second largest portion at 37.3 percent, followed by natural resources (6.5 percent), and sales taxes (5 percent).

TABLE 3-30
TRIBAL WORKFORCE AND UNEMPLOYMENT (1999)

Tribe	County	Total Tribal Enrollment	Available for Work of Total Work Force	Unemployed as % of Labor Force	Percent Employed but Below Poverty Guideline
Crow Tribe of Montana	Big Horn County	10,083	3,902	61%	38%
Northern Cheyenne Tribe	Big Horn County, Rosebud County	7,473	2,437	71%	26%
Fort Belknap Indian Community	Blaine County	5,223	2,780	76%	40%
Montana (all tribes)		61,203	26,348	61%	33%

Source: BIA 1999

TABLE 3-31
PER CAPITA INCOME, 1996-1998

	Dollars per Year			% Average Annual Increase (1996-1998)	% of State Average (1998)
	1996	1997	1998		
Big Horn County	11,987	12,418	13,239	5.1%	62.4%
Blaine County	13,357	13,764	15,358	7.2%	72.3%
Carbon County	17,798	18,901	19,745	5.3%	93.0%
Carter County	11,793	12,480	13,139	5.6%	61.9%
Custer County	18,879	19,792	20,487	4.2%	96.5%
Gallatin County	21,019	21,889	22,820	4.2%	107.5%
Golden Valley County	14,471	15,115	16,095	5.5%	75.8%
Musselshell County	13,087	14,047	14,351	4.7%	67.6%
Park County	17,578	17,756	18,708	3.2%	88.1%
Powder River County	13,593	15,061	16,314	9.6%	76.8%
Rosebud County	16,395	17,423	18,066	5.0%	85.1%
Stillwater County	18,114	18,726	19,736	4.4%	93.0%
Sweet Grass County	16,871	18,591	19,032	6.2%	89.7%
Treasure County	15,208	14,744	15,707	1.6%	74.0%
Wheatland County	14,784	16,695	16,217	4.7%	76.4%
Yellowstone County	22,173	23,168	24,425	5.0%	115.1%
Planning Area	**16,069**	**16,911**	**17,715**	**5.0%**	**83.4%**
Montana	**19,383**	**20,130**	**21,229**	**4.7%**	**100.0%**
U.S.	**24,651**	**25,924**	**27,203**	**5.0%**	

Source: Bureau of Economic Analysis 2001

TABLE 3-32
TOTAL TAXES COLLECTED IN MONTANA (2000)

	2000 Tax Revenues Collected in Montana	Percent of Total
Property Taxes	$789,786,040	51.2%
Income Taxes	$575,094,186	37.3%
Natural Resource Taxes	$100,063,319	6.5%
Selected Sales Taxes	$77,860,652	5.0%
Montana Total	**$1,542,804,197**	**100.0%**

Source: Montana Department of Revenue (2000)

The taxes and royalties assessed on oil and gas development and production are an important source of revenue for local governments and the State of Montana. The oil and gas industry pays rents, royalties, and bonuses on federal leases; production taxes on working and non-working interests in the State of Montana; and local property taxes on drilling and production equipment.

Generally, as county oil and gas production tax revenues increase (e.g., because of new oil and gas production), the property tax rate (mill levy) for the county is decreased accordingly. A percent of state-levied oil and gas production taxes are distributed to the counties based on the county where production occurred. For natural gas, 86 percent of the production taxes are distributed to the counties for local governments and schools. For oil, 60.7 percent of the production taxes are distributed to the counties. See the Socioeconomics Appendix for more information on taxes.

State Oil and Gas Lease Income

DNRC leases oil and gas, metalliferous and non-metalliferous, coal, sand, and gravel mineral rights agreements on 6.3 million acres of school trust lands, and more than 100,000 acres of other state-owned land throughout Montana. School trust lands are lands historically granted to the State of Montana to be used to support common schools and other educational and state institutions.

State mineral lease royalties are collected from production facilities located on state lands. Royalty payments are based on the volume of oil and gas produced and the price of the commodity. Rental and royalty revenues are either deposited into the appropriate permanent or distributable school trust or the state general fund. Table 3-33 presents the revenues received by the state in fiscal year (FY) 2000 from minerals management, including leases (rents) and mineral production royalties on state trust lands. Oil and gas revenues in FY 2000 were $6.6 million, or 57.2 percent of total state mineral management revenues. Oil and gas revenues comprised the largest share, with coal revenues the second largest, at 40.3 percent of the total.

The state mineral leasing program includes 2,433 oil and gas leases, 534 of which are currently productive. From FY 1999 and FY 2000, the number of oil and gas leases increased by 8.1 percent and the number of productive leases increased by 14.3 percent. In FY 2000, state lands yielded 923,777 barrels of oil, 5,050,552 million cubic feet of gas, and 375,113 gallons of condensate. Oil production declined 6.5 percent from FY 1999. However, the increase in average price from $10.50 per barrel in FY 1999 to $20.21 per barrel in FY 2000 accounted for the large increase in oil royalty revenue. Gas production in FY 2000 increased 19.6 percent, while price increased 36.0 percent compared to FY 1999, also resulting in a substantial increase in royalty revenue.

Federal Mineral Revenues

Oil and gas royalties are earned from production facilities on federal leases, units, or communitization agreements. Federal mineral lease royalties are collected on oil and gas produced based on the volume of product. Table 3-34 presents federal mineral revenue disbursements by county of origin for the 16 planning area counties and the state as a whole. Coal, gas, and oil are the main mineral products. The totals reported do not include royalties and rents from leases on Native American tribal and allotted lands.

TABLE 3-33
REVENUES RECEIVED FROM MINERALS MANAGEMENT ON STATE LANDS IN FY 2000

	FY 2000 Revenue (Dollars)
Oil and Gas	
Rentals/Bonuses/Penalties	2,966,285
Royalties	3,684,595
Seismic Exploration	11,075
Subtotal	6,661,955
Percent	57.2%
Aggregate Minerals	
Rentals	250
Royalties	245,693
Subtotal	245,943
Percent	2.1%
Coal	
Rentals	44,371
Royalties	4,649,634
Subtotal	4,694,005
Percent	40.3%
Other Minerals	
Subtotal	41,124
Percent	0.4%
Rentals/Penalties	32,246
Royalties	8,878
TOTAL	11,643,027

Source: MDNRC 2000 (www.dnrc.state.mt.us/trust/mmb.htm)

TABLE 3-34
ONSHORE FEDERAL MINERAL REVENUE DISBURSEMENTS IDENTIFIED BY COUNTY OF ORIGIN, FISCAL YEAR 2000, MONTANA[1]

	Product	Sales Volume ($)	Royalty Value ($)	Disbursed to State ($)
Big Horn	Bonus		185,076	92,538
	Coal	20,416,210	20,912,616	10,456,308
	Gas	44,411	4,028	2,014
	Other Revenues		16,562	8,281
	Rent		335,127	167,564
	Subtotal		21,453,409	10,726,705
Blaine	Bonus		251,411	125,705
	Gas	1,559,733	460,736	230,368
	Oil	35,238	69,797	34,898
	Other Revenues		64,995	32,497
	Rent		105,524	52,762
	Subtotal		952,462	476,231
Carbon	Gas	166,547	45,722	22,861
	Gas Plant Products	2,789,164	89,617	44,809
	Oil	386,161	1,042,440	521,220
	Other Revenues		2,616,601	1,308,301
	Rent		76,892	38,446
	Sulfur	1,023	524	262
	Subtotal		3,871,797	1,935,899
Carter	Bonus		47,366	23,683
	Oil	865	1,888	944
	Other Revenues		22,294	11,147
	Rent		90,429	45,214
	Subtotal		161,976	80,988
Custer	Bonus		51,904	25,952
	Gas	56,563	11,875	5,938
	Other Revenues		1,135	568
	Rent		44,205	22,103
	Subtotal		109,119	54,560
Gallatin	Rent		5,127	2,564
	Subtotal		5,127	2,564
Golden Valley			0	0
Musselshell	Bonus		594	297
	Oil	5,378	2,394	1,197
	Other Revenues		1,077	539
	Rent		19,030	9,515
	Subtotal		23,095	11,547
Park			0	0

TABLE 3-34
ONSHORE FEDERAL MINERAL REVENUE DISBURSEMENTS IDENTIFIED BY COUNTY OF ORIGIN, FISCAL YEAR 2000, MONTANA[1]

	Product	Sales Volume ($)	Royalty Value ($)	Disbursed to State ($)
Powder River	Bonus		39,028	19,514
	Gas	14,352	4,076	2,038
	Oil	74,079	172,508	86,254
	Other Revenues		6,796	3,398
	Rent		482,732	241,366
	Subtotal		705,139	352,569
Rosebud	Bonus		517,040	258,520
	Coal	1,612,516	1,852,468	926,234
	Oil	21,613	42,355	21,178
	Other Revenues		690,601	345,301
	Rent		220,533	110,266
	Subtotal		3,322,997	1,661,499
Stillwater	Bonus		6,766	3,383
	Oil	3,499	5,222	2,611
	Rent		26,077	13,039
	Subtotal		38,066	19,033
Sweet Grass	Bonus		8,928	4,464
	Rent		25,854	12,927
	Subtotal		34,782	17,391
Treasure	Coal	97,143	118,745	59,372
	Rent		2,760	1,380
	Subtotal		121,505	60,752
Wheatland	Other Revenues		480	240
	Subtotal		480	240
Yellowstone	Oil	1,648	2,494	1,247
	Other Revenues		516	258
	Rent		131	65
	Subtotal		3,140	1,570
Planning Area Total			30,768,312	15,384,156
% of State Total			71.8%	75.4%
Montana Total[2]			42,881,292	20,401,472

Source: U.S Department of Interior, Minerals Management Service 2001.
[1]Does not include revenues collected from American Indian lands or offshore operations.
[2]Adjusted for net receipts sharing (less $1,039,174 disbursed to state).

Mineral royalties from the 16 planning area counties totaled $30.7 million—approximately 71.8 percent of the $42.8 million collected in the state. Big Horn County accounted for a large share of the planning area revenues, with total royalties of $21.4 million, which were mostly from coal. Coal and oil revenues are far greater than gas revenues.

Formulas for disbursement of revenues from federal mineral leases are governed by legislation and regulations. Nationally, in fiscal year 2000, federal mineral lease revenues were disbursed as follows: 66.0 percent to the U.S. Treasury; 20.2 percent to special purpose funds, such as historic preservation, land and water conservation, and reclamation; 10.8 percent to states; and 3.0 percent to Native American tribes. This corresponds to $5.1 billion to the U.S. Treasury, $1.6 billion to special purpose funds, $843 million to states, and $235 million to tribes.

Federal legislation provides that Montana receive 50 percent of the net receipts of all bonuses, rents, and royalties collected on BLM-administered lands within Montana. As a result, the percentage of royalties disbursed in Montana is much greater than the national average. Of the $42.8 million in royalties collected on federal lands in Montana counties in 2000, nearly half, or $20.4 million, was disbursed to the state.

Private Landowner Revenue

Some landowners in Montana own the mineral rights to their land and lease those rights for natural gas development and other uses. Landowners who do not own mineral rights may be subject to the development of natural gas or other energy or mineral resources on their land. Both of these categories of landowners receive income for use of their land, in the form of natural gas royalties or one-time compensation for land disturbance and use, respectively. This income is included in the total per capita incomes presented in Table 3-31.

Water Resource Values

Water plays an important role in the state and local economies of Montana. Water is a scarce resource in Montana—particularly in eastern Montana. Many of the state's surface water basins are over-appropriated and have been closed to future appropriations. In these locations, water users are turning more and more to groundwater to meet their water needs.

Most of the water in the planning area originates as groundwater. Livestock watering and domestic water wells are the primary uses of groundwater in the area. Surface water and groundwater are also used for agricultural irrigation and surface water is used for recreation in some areas. Continued availability of adequate quantity and quality for these major uses is essential to maintaining the health of these sectors of the local and state economies.

The economic value of water resources for human uses varies greatly by location and by use and user. As an example, it has been estimated that the value of irrigation water to agricultural producers, based on the increase in production attributable to the use of the water for irrigation, is between $25 and $50 per acre-foot in eastern Montana (Schaefer 2001). Costs for domestic water would generally be more. The values are inherent components of the values of the various sectors of the economy, such as income from grazing and agriculture or costs of providing public water service. Changes in the supply or cost of water would contribute to changes in the costs and revenues for these activities.

Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations" (1994) requires the non-discriminatory treatment of minority populations and low-income populations for projects that occur on federal lands, require federal permits, use federal funds, or are otherwise under the jurisdiction of a federal agency. Disproportionately high or adverse health or environmental effects on such populations must be identified and addressed as appropriate.

Low-Income and Minority Populations

This section describes locations of concentrations of minority populations and low-income populations at the county level, in accordance with the scope of this study. Potential sub-county concentrations of minority populations and low-income populations are also possible but could only be identified on a project-specific basis. The occurrences of minority populations and low-income populations are discussed in detail in the Demographics section of this report, and are presented in Tables 3-23 and 3-24, respectively.

The Montana population is 92.2 percent white, similar to the 16-county study area, which is 91.5 percent white. While 13 of the 16 study-area counties are between 94.5 percent and 99.1 percent white, three of the counties—Big Horn, Blaine, and Rosebud—include Indian reservations with substantial Native American populations. Big Horn County, where the population is 59.7 percent Native American, includes most of the Crow Reservation and part of the Northern Cheyenne Reservation. Rosebud County also includes part of the

Northern Cheyenne Reservation and is 32.4 percent Native American. Bighorn and Rosebud counties are two of the counties with the most potential for CBM needs. Blaine County includes most of the Fort Belknap Reservation and is 45.4 percent Native American.

The percentage of the Montana population living in poverty is 15.5 percent; the average in the 16-county study area is 17.3 percent. The study area contains 39,093 persons below the poverty level, or about 28.8 percent of the state's total below the poverty level. Nine of the 16 study-area counties have poverty rates greater than the state average. The two counties with the highest rate are Big Horn and Blaine, where more than one quarter of the population had an income below the poverty level in 1997.

Two typical field compressors. These four-stage, 6.0 million cubic foot per day, reciprocal compressors operate at 380 horsepower and use natural gas as a fuel.

Soils

Montana, with its wide mix of geologic parent material, has a vast array of different soil types. Differences in climate, parent material, topography, and erosional conditions result in soils with diverse physical and chemical properties. The distribution and occurrence of soils can be highly variable and is dependent on a number of factors including slope, geology, vegetation, climate, and age. For more information on soil types, see the Soils Appendix.

The five major soil forming factors are as follows (Brady 1990):

1. Climate—particularly temperature and precipitation.
2. Living Organisms—especially native vegetation, microbes, soil animals, and human beings.
3. Nature of parent material.
4. Topography of the site.
5. Time that parent materials are subject to soil formation.

Soils in the RMP areas are derived mainly from sedimentary bedrock and alluvium. The soils generally range from loams to clays, but are principally loams to silty clay loams.

Soil salinity affects the suitability of a soil for crop production and the stability of the soil. The SAR is the measure of sodium relative to calcium and magnesium, and affects the soil structure and infiltration rate of water. The Soils Technical Report presents a more detailed discussion pertaining to the salinity and SAR of the soils in the Billings RMP and Powder River RMP areas. A summary of this report is presented in the Soils Appendix.

Solid and Hazardous Wastes

The hazardous materials program priorities are to protect the public health and safety; protect natural and environmental resources; comply with applicable federal and state laws and regulations; and minimize future hazardous substance risks, costs, and liabilities on public lands. BLM is responsible for all releases of hazardous materials on public lands and requires notification of all hazardous materials to be used or transported on public land.

Solid and hazardous wastes can be generated during oil and gas and CBM activity. These wastes are under the jurisdiction of the MDEQ for Resource Conservation and Recovery Act (RCRA) wastes; the MBOGC for RCRA-exempt wastes such as drilling wastes; and the EPA on tribal lands. At the present time, wastes generated from the wellhead through the production stream to and through the gas plant are exempt from regulation as a hazardous waste under RCRA's exploration and production exemption, but are covered by mineral leasing regulations.

The exemption does not apply to natural gas as it leaves the gas plant for transportation to market. Releases must be reported in a timely manner to the National Response Center the same as any release covered under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Prior to a gas plant, releases are reported to the BLM via a Report of Undesirable Event (NTL-3A; 43 CFR 3162.5-1(c)). The BLM requires immediate reporting of all Class I events, which involve the release of more than 100 barrels of fluid/500 MCF of gas, or fatalities. The MDEQ's Solid and Hazardous Waste Bureau is responsible for administering both the Montana Solid Waste Management Act (75-10-201 *et. seq.*, Montana Code Annotated [MCA]) and the Montana Hazardous Waste Act (75-10-401 *et seq.* MCA).

It has been established by CERCLA that the owner of the land is ultimately responsible for hazardous materials or substances placed or released on their lands. Under CERCLA, the term "hazardous substance" is typically any toxic, corrosive, ignitable, explosive, or chemically reactive substance, but does not include petroleum, crude oil, natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel, or mixtures of natural gas and synthetic gas. According to MCA 82-10-505: the oil and gas developer or operator is responsible for all damages to property, real or personal, resulting from the lack of ordinary care by the oil and gas developer or operator. The oil and gas developer or operator is responsible for damages to property, real or personal, caused by drilling operations and production. This places the liability of any cleanup that results from spills or unused non-exempt waste and the removal of such waste (paint, acid, or other chemicals) to the oil and gas developer and operator. The oil and gas industry transports hazardous materials on the highways, stores and uses the materials at the sites, and produces some hazardous wastes, such as paint waste from the painting of facilities, and unused acid or chemicals that were not used in well treatments. This presents a potential for spills, leaks, and illegal disposal. Reserve pits may be required to be lined, which reduces but does not eliminate leaks. Produced water is the predominant fluid, but some hazardous substances also are released. The content of the releases or spills will be varied and unpredictable.

The transportation of hazardous materials is regulated by Montana's Department of Transportation (MDT) under CFR Parts 171-180. These regulations pertain to packing, container handling, labeling, vehicle placarding, and other safety aspects. The transportation of all hazardous waste materials in Montana must comply with the Federal Motor Carrier Safety Regulations, part 390 through part 397.

The EPA requires manufacturers to report releases of more than 600 designated toxic chemicals into the environment. EPA compiles this data in an annual Toxics Release Inventory. Toxics Release Inventory facilities are required to report on releases of toxic chemicals into the air, water, and land. In addition, they report on offsite, pollution prevention activities and chemical recycling. The Toxics Release Inventory also provides information about potentially hazardous chemicals and their use; however, the law does not cover toxic chemicals that reach the environment from non-industrial sources, such as dry cleaners or auto service stations.

In 1998, EPA added seven new industries to the Toxics Release Inventory: metal mining, coal mining, electrical utilities that combust coal or oil, RCRA Subtitle C hazardous waste treatment and disposal facilities, chemicals and allied products wholesale distributors, petroleum bulk plants and terminals, and solvent recovery services. There are currently 19 facilities in the RMP areas that report Toxics Release Inventory information to the EPA, with most of them being related to the energy and mining industries. The Solid and Hazardous Waste Appendix contains *the Toxics Release Inventory for Montana*.

Vegetation

The land classification system developed by the University of Montana for the Montana Gap Analysis (MT-GAP) is used for this discussion because it has a large amount of detailed information about vegetation and wildlife distribution. All classification descriptions are from the MT-GAP project, and acreage estimates and calculations are based on their data results (Fisher et al. 1998).

The planning area includes six general land classes or vegetative communities: Agriculture/Urban Areas, Grassland, Shrubland, Forests, Riparian Areas, and Barren Lands. (Non-riparian wetlands are also present but are widespread and generally in relatively small areal units compared to other land classes, so are not defined separately.) The five general land classification descriptions and their subdivisions will be explained in more detail below. All of these habitats are important to a wide variety of wildlife species.

Plant Communities

Grasslands

Grasslands are among the most biologically productive of all vegetative communities because of soil nutrient retention and fast biological recycling. They are also very valuable because the vegetation is nutritious and used by livestock and by a large constituent of wildlife (Williams and Diebel 1996, Estes et al. 1982). Grassland sites are dominated by herbaceous canopy cover at greater than 15 percent, shrub cover at less than 15 percent, and forest cover at less than 10 percent (Fisher et al. 1998).

Grasslands cover an estimated 10.4 million acres of the 16 counties that make up the CBM emphasis area. This is almost twice as much land as any other vegetation type in the planning area. Those grasslands with underlying subbituminous or bituminous coal deposits cover 1.5 million acres of the Powder River RMP area and 1 million acres of the Billings RMP area. Together, the counties of Park, Blaine, and Gallatin have nearly 1 million acres of grasslands underlain by coal within their boundaries. For grassland types, see the Vegetation Appendix.

Shrublands

Shrublands are characterized by shrub covers greater than 15 percent and forest cover less than 10 percent (Fisher et al. 1998). This vegetation type is dominant on approximately 5 million acres of the CBM emphasis area. Of this, 1.8 million acres are underlain by bituminous coal deposits. Important shrubs include several species of sagebrush (*Artemisia nova*, *A. tridentata*, *A. vaseyana*, and *A. wyomingensis*). Other important shrub species in this category are bitterbrush (*Purshia tridentata*), creeping juniper (*Juniperus horizontalis*), greasewood (*Sarcobatus* spp.), mountain mahogany (*Cercocarpus* spp.), rabbitbrush (*Chrysothamnus* spp.), and shadscale (*Atriplex canescens*). These shrublands are often associated with a complex of understory grasses such as bluebunch wheatgrass (*Agropyron spicatum*), blue grama (*Bouteloua gracilis*), Idaho fescue (*Festuca idahoensis*), needle and thread (*Stipa comata*), and western wheatgrass (*Agropyron smithii*).

Forests

Land is classified as forest if it has more than 10 percent tree cover. Montana has 19 categories of forests under this classification. Within the emphasis area, 4.5 million acres are classified as forest. Of that, almost 1.4 million acres are underlain by subbituminous or bituminous coal deposits. Two forest types account for the majority of the forested areas within the emphasis area: Ponderosa Pine Forests and Low-Density Xeric Forests. Ponderosa Pine sites are dominated by ponderosa pine (*Pinus ponderosa*) at 20 to 80 percent cover. They are associated with big sagebrush, ninebark, snowberry, bluebunch wheatgrass, blue grama, and Idaho fescue. Low-density xeric forests have tree cover at 5 to 20 percent with a grass understory. Dominant tree species are Douglas fir, limber pine, ponderosa pine, Rocky Mountain juniper, or Utah juniper (Fisher et al. 1998).

Riparian Areas

These are sites that are associated with intermittent and perennial water sources or with woody draws. Riparian areas are classified as Conifer, Broadleaf, Mixed Broadleaf and Conifer, Graminoid and Forb, Shrub, and Mixed (Fisher et al. 1998). All riparian types have high species richness, which reaffirms why riparian sites are considered to be some of the most biologically diverse habitats anywhere.

Other Wetlands

Wetlands not associated with streams or rivers (riparian) are found in many low areas across Montana. In general, these wetlands (palustrine) are dominated by either emergent marsh vegetation, such as cattails, sedges, and/rushes, or by shrub vegetation, such as willows. Forested wetlands many also be present in some areas.

Barren Lands

These are sites with less than 10 percent forest cover, less than 10 percent shrub cover, and less than 10 percent herbaceous cover (Fisher et al. 1998). The category name may imply that these areas have no biological value, but this would be misleading.

Noxious Weeds

Although the word "noxious" means harmful or deleterious, in this context it is a legal term for species of plants that have been designated "noxious" by law. Noxious weeds are non-native species with the potential to spread rapidly—usually through superior reproductive capacity, competitive advantage mechanisms, and lack of natural enemies.

Fourteen species have been defined as Category 1 noxious weeds for Montana; these weeds are currently known to be established within the state. Approximately 87,365 acres within the CBM emphasis area that are underlain by subbituminous or bituminous coal beds are considered to be altered by exotic or introduced plant species (defined by 30 percent or more of vegetative cover coming from non-native species). Not all of these are in the "noxious" weed category, but this switch from native plants is an indication of the potential scope of the issue.

- **Spotted Knapweed** (*Centaurea maculosa*): Since the 1920s, this perennial has spread from western Montana to every county in Montana. It covers an estimated 5 million acres of Montana land. This species readily establishes itself on disturbed sites and has the competitive advantage over many native species because it starts growth early in spring.
- **Diffuse Knapweed** (*Centaurea diffusa*): This aster invades roadsides, waste areas, and dry rangelands. It is highly competitive and able to exclude many native species.
- **Hoary Cress (Whitetop)** (*Cardaria chalepensis*): This invader is well adapted to moist habitats such as sub-irrigated pasture, hay fields, rangelands, and roadsides. In unshaded areas that have been disturbed, it can form dense monocultures.
- **Dyer's Woad** (*Isatis tinctoria*): This species was first reported in Montana in the 1950s. It tends to invade dry, rocky soils in rugged terrain. A chemical in the seedpods can inhibit the germination of seeds from other plants. It has been confirmed to be in two counties within the planning area: Musselshell and Park.
- **Oxeye Daisy** (*Chrysanthemum leucanthemum*): This perennial invades by both prolific seed production and by branching rhizomes and adventitious roots. It prefers upland pastures and meadows, but also grows along waste areas in western and southern Montana.
- **Dalmatian Toadflax** (*Linaria dalmatica*): This species grows in a wide range of habitats, especially if soils are well drained and coarse-textured. Wet conditions seem to limit the success of this species.
- **St. John's Wort** (*Hypericum perforatum*): This perennial covers about 500,000 acres in Montana. It is particularly adapted to sandy or gravelly soils. It reproduces by both seeds and short runners.
- **Leafy Spurge** (*Euphorbia esula*): Leafy spurge began to invade eastern Montana as early as 1925 and now is known to be in every county. It is most aggressive in dry areas where competition from native plants is less robust.
- **Purple Loosestrife** (*Lythrum salicaria*): This species' fast growth and enormous reproductive ability allow it to choke native vegetation out of wetlands.
- **Saltcedar** *(Tamarix ramosissima):* Saltceder is an aggressive woody invader. It prefers waterways and ponds and can transpire up to 200 gallons of water per day. It forms dense monocultures that provide little or no habitat for wildlife. It exudes salts onto the surrounding surface rendering the inter-spaces uninhabitable to other vegetation.

See the Vegetation Appendix for a complete list of noxious weeds for Montana.

Species of Concern

Many federally listed threatened, endangered, or candidate species of special concern exist in the planning area that are given special consideration under Section 7(c) of the Endangered Species Act of 1973 (ESA). As required by the ESA, the FWS has provided a list of endangered, threatened, and proposed species that may be present in the planning area (see Table 3-35). This section reviews its habitat requirements, as well as the likelihood of this species being found in the 16 counties that may be potentially affected.

TABLE 3-35
ENDANGERED, THREATENED, AND PROPOSED PLANT SPECIES PRESENT IN THE CBM EMPHASIS AREA

Common Name	Scientific Name	Habitat in Montana	Federal Status*
Ute ladies'-tresses orchid	*Spiranthes diluvialis*	River meander wetlands in Jefferson, Madison, Beaverhead, and Gallatin counties	T

*T = Threatened

Ute Ladies'-Tresses Orchid

This plant was listed as Threatened January 17, 1992 (57 Federal Register [FR] 2053). Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial streams. It occurs primarily on sites subject to intermittent and unpredictable inundation, and the plants often emerge from shallow water (Sheviak 1984, FWS 1996).

The species occurs primarily in areas where the vegetation is relatively open and not overly dense, overgrown, or overgrazed (Coyner 1989, 1990, Jennings 1989, 1990). In Montana, it is found in meandered wetlands and swales in broad, open valleys, at margins with calcareous carbonate accumulation (Montana NRIS 2001). It is known to occur only in southwestern Montana in Beaverhead, Gallatin, Jefferson, and Madison counties.

State Species of Concern

In addition to species that are federally protected under the ESA, the State of Montana has designated additional species of concern within its jurisdictional boundaries. There are five rankings for State Species of Special Concern. This document focuses only on the highest ranking (S1). This ranking is defined as critically imperiled because of extreme rarity (five or fewer occurrences, or very few remaining individuals), or because some factor of its biology make it especially vulnerable to extinction.

State-listed species (with BLM and Forest Service rankings) that have potential distributions within the 16-county emphasis area of this EIS or that have undefined distributions in the state are listed in the Vegetation Appendix (see Plant Species of Concern in the 16 County Planning Area). Species that are federally listed under the ESA have been omitted from these tables because they have already been considered. The Vegetation Appendix also includes the type of habitat where they are likely to be found. (Montana NRIS 2001). Table VEG-6 links wildlife species to habitat requirements.

Plant species are listed by county where each state species of concern is known to occur (Vegetation Appendix). Sensitive species for the BLM and USFS are also listed in this appendix. Historic maps for most species of concern show much wider distributions than present distributions.

Visual Resource Management

Visual resources are visual features in the Montana landscape that include landform, water, vegetation, color, adjacent scenery, uniqueness or rarity, structures, and other man-made features. The 16 counties in the emphasis area portray a variety of landscapes and habitats, all with different visual qualities. Current visual resource management is in accordance with the two RMPs. The four classes are as follows:

- Class I—preserve the existing character of the landscape
- Class II—retain the existing character of the landscape
- Class III—partially retain the existing character of the landscape
- Class IV—provide for management activities that require major modifications to the existing character of the landscape

Non-federal land is not under any visual resource management system although there are often visual quality concerns. Federally authorized projects, however, undergo a visual assessment to comply with aesthetic requirements. Typically, sensitive areas include residential areas, recreation sites, historical sites, significant landmarks or topographic features, or any areas where existing visual quality is valued.

Three CBM well heads forming a field pod near Decker, Montana. Each well is drilled to a different depth and into a different layer of coal.

Wilderness Study Areas

Ten wilderness study areas are within the planning area:

- Carbon County
  - Burnt Timber Canyon WSA
  - Pryor Mountain WSA
  - Big Horn Tack-On WSA
- Golden Valley County
  - Twin Coulee WSA
- Park County
  - Yellowstone River Island WSA
- Blaine County
  - Stafford WSA
  - Ervin Ridge WSA
  - Cow Creek WSA
- Rosebud County
  - Zook Creek WSA
- Powder River County
  - Buffalo Creek WSA

Monitoring reports for these WSAs list little or no activity with the exception of some minor vehicle tracks found in the Cow Creek WSA, Stafford WSA, Pryor Mountain WSA, Big Horn Tack-On WSA, and Burnt Timber Canyon WSA.

Wildlife

The EIS planning area covers very large portions of southeast, south central, and north central Montana, and includes substantial geographic and topographic variation and a wide variety of plant communities and wildlife habitat types. This combination of factors results in very diverse wildlife communities, with some species having widespread occurrence throughout the planning area and others being restricted to one or a few specialized habitats and locations.

The Vegetation section described the predominant native plant communities that provide habitat for wildlife in the planning area. These include a variety of grassland, shrubland, forest, and riparian habitat types. Drier grasslands and shrublands are dominant with breaks, badlands, coulees, wooded draws, open conifer forests, and riparian shrub and forest communities along perennial and intermittent drainages. Two other cover types present in the planning area include open water and a variety of agricultural land uses, both of which provide important habitat value to certain species during some seasons. Additionally, special habitat features such as cliffs, snags, springs, natural potholes, reservoirs, lakes, and islands are present in the planning area.

Mammals

The variety of locations, topography, and cover types in the planning area support many mammal species. The MT-GAP atlas of terrestrial vertebrates (MT-GAP 1998) shows the known distribution of vertebrates in Montana. It indicates that the planning area supports 10 species of bats; 8 species of shrews; 34 other species of small mammals and lagomorphs; 17 omnivores or predators ranging in size from the least weasel (*Mustela nivalis*) to the black bear (*Ursus americanus*) and mountain lion (*Felis concolor*); and 5 to perhaps 7 big game species. Several of these species have suffered substantial habitat loss and population decline and are considered to be rare or are protected by federal statutes. These species are addressed in the Species of Concern (SOC) section.

Some of the more common predators include the coyote (*Canis latrans*), red fox *(Vulpes vulpes*), raccoon (*Procyon lotor*), badger (*Taxidea taxus*), and striped skunk (*Mephitis mehpitis*). Local occurrence of several of these and other predators varies by habitat type present.

Big game species common within parts or all of the planning area include elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), and pronghorn (*Antilocapra americana*). The MT-GAP (1998) provides the following summary of habitat preferences for these species.

Elk habitat preference is described as including moist sites during the summer. Elk use open areas such as alpine pastures, marshy meadows, river flats, and aspen parkland as well as coniferous forests, brushy clearcuts, and forest edges. High-quality winter range is critical to long-term elk survival.

Mule deer are the most widely distributed big game species in Montana and occupy a wide range of habitat types during the year. Breaks, badlands, and brushy draws are preferred in open prairie country. McCracken and Uresk (1984) reported that both hardwood and pine forests were important to mule deer in southeastern Montana, with hardwood forests preferred. The Billings RMP (BLM 1983) indicates that although mule deer occur throughout the planning area, they are more abundant in the open shrub-grassland habitats adjacent to timbered or broken terrain. Habitat such as riparian bottoms, agricultural areas, and forests are used as well, either year long or seasonally. Winter ranges are typically at lower elevation than summer ranges, and are often dominated by shrub species that provide crucial browse.

White-tailed deer also occur throughout Montana but are more restricted by habitat preference than are mule deer. Preferred habitats include forest types, agricultural fields, and prairie areas adjacent to cover. Mesic areas such as riparian areas and montane forests are preferred in the drier portions of central and eastern Montana. McCracken and Uresk (1984) reported a strong preference for hardwood forests in southeastern Montana. During the winter, white-tailed deer using forested areas prefer dense canopy classes, moist habitat types, uncut areas, and low snow depths. Winter concentration areas occur almost exclusively in riparian-wetland habitats and in dense pine (Youmans and Swenson 1982). White-tailed deer tend to remain in one particular area and do not migrate in the winter (Hamlin 1978).

Pronghorn are relatively common throughout eastern and central Montana and occupy a variety of grassland and shrubland habitats on prairies, semi-desert areas, and foothills. Summer habitat preferences are reported to include mixed shrub communities, perennial grasslands, silver sagebrush stands, annual forblands, and croplands (Armstrup 1978, Wentland 1968). McCracken and Uresk (1984) reported a strong preference to sagebrush-grassland cover types in southeastern Montana. Sagebrush-grasslands with shrubs 12 to 24 inches tall are preferred in the winter

when sagebrush composes a significant portion of the pronghorn diet (Bayless 1967).

The range of moose (*Alces alces*) overlaps with coal-bearing lands in Carbon County. Moose habitat generally consists of a mosaic of second-growth forest, openings, swamps, lakes, and wetlands. Water bodies are required for foraging and hardwood-conifer forests provide winter cover. Willow flats may provide yearlong habitat in some areas (Stone 1971) and closed canopy stands may be important in late winter (Mattson and Despain 1985).

The other two big game species that may occur in the planning area include the mountain goat (*Oreamnos americanus*) and mountain bighorn sheep (*Ovis canadensis*). Mountain goats typically occupy alpine and subalpine habitats, steep grassy talus slopes, grassy ledges and cliffs, or alpine meadows. Both mountain goats and mountain sheep may overlap with coal-bearing lands in southwestern and southern Carbon County, respectively. The Pryor Mountain bighorn herd, which occurs south of Billings, is estimated at 100 individuals (BLM 1983). Grasses and forbs provide the major portion of their yearlong diet, which is supplemented with browse types such as curlleaf mountain mahogany and sagebrush (FWS 1978). Little information is currently available on the migratory routes of this herd.

In eastern Montana, most mule deer and elk winter range is located on relatively large areas of land with a diversity of slopes, aspects, and topographic features (MBOGC 1989). Winter range is often part of year-round habitat.

Prairie dog towns provide habitat for more than 163 vertebrate species, including several rare or endangered species such as the burrowing owl (*Athene cunicularia*), swift fox (*Vulpes velox*), mountain plover (*Charadrius montanus*), and black-footed ferret (*Mustela nigripes*)—which is an endangered species (Reading et al. 1989, Koford 1958, Tyler 1968, Campbell and Clark 1981, Clark et al. 1982, and Agnew 1983). Black-tailed prairie dogs (*Cynomys ludivicianus*) formerly occupied most of the planning area along with thousands of acres of adjacent short grass prairie lands. White-tailed prairie dogs (*C. leucurus*) are found only along the Clarks Fork of the Yellowstone River in Carbon County, which is at the northern limit of its range.

As noted above, at least 10 species of bats probably occur in the planning area. Additional species migrate through central and eastern Montana. These sites vary by species and include caves, large-diameter hollow trees, old buildings, abandoned mines, rock crevices, and under the loose bark on large trees.

As noted above, at least 42 species of shrews and other small mammals and lagomorphs occur in the planning area. MFWP has expressed particular concern about the Preble's shrew (*Sorex preblei*) and Merriam's shrew (*S merriami*). Preble's shrew has a spotty distribution associated with dry sagebrush and sagebrush grasslands (Hoffman and Pattie 1968) and riparian shrubs (Allen et al. 1994, Ports and George 1990). Merriam's shrew is apparently somewhat more widely distributed in the planning area. It occupies the same general habitat types as the Preble's shrew plus grasslands and open ponderosa pine stands (MT-GAP 1998).

Birds

As noted for mammals, the variety of locations, topography, and cover types in the planning area also support many bird species. The MT-GAP (1998) indicates that more than 250 species of birds occur in the emphasis area. Some are yearlong residents, a few migrate south into the emphasis area during the winter, and most breed in the emphasis area and winter to the south. Approximate numbers of species include 32 waterfowl and related species; 33 shore and wading birds; 18 diurnal and 11 nocturnal raptors; 8 species of gallinaceous birds; 8 woodpeckers; and 137 songbirds, including many neotropical migrants. Species richness and breeding bird densities are highest in riparian woodlands and wetland habitats.

Waterfowl

The planning area is within the Central Flyway, which has important migration corridors. Lands in the planning area also fall within the Prairie Pothole Joint Venture established through the North American Waterfowl Management Plan. The Prairie Pothole Joint Venture is thought to contain the most important duck-breeding habitat in North America. Many spring runoff ponds in the planning area provide important habitat for nesting waterfowl. The major rivers and stockponds provide important habitat for resident ducks and nesting areas for migrants. A large variety of ducks, geese, and shorebirds use riparian-wetland habitats within the planning area for both nesting and migration stopovers. Common species include the mallard (*Anas platyrhynchos*), pintail (*A. acuta*), gadwall (*A. strepera*), blue-winged teal (*A. discors*), common merganser (*Mergus merganser*), Canada goose (*Branta canadensis*), killdeer (*Charadrius vociferus*), and avocet (*Recurvirostra americana*). The Yellowstone and Clarks Fork drainages are used heavily for nesting

by Canada geese and some species of ducks. Nesting occurs mostly on established islands and brushy riparian-wetland areas where abundant cover provides protection from predators.

Hansen (2001) identified several specific areas that are important to waterfowl and shorebirds. One critical habitat (for waterfowl and shorebird nesting and migration) is the Lake Mason National Wildlife Refuge (NWR), its entire watershed, and some associated shallow lakes located in Mussellshell County. Another is the Spidel Waterfowl Production Area, another FWS area for waterfowl and shorebirds located at the edge of one of the coal areas about 3 miles northeast of Broadview. A group of major waterfowl and shorebird areas located in Stillwater County between Molt and Rapelje includes Big Lake, Halfbreed NWR, and Hailstone NWR.

The Yellowstone River through Yellowstone, Big Horn, Treasure, Rosebud, and Custer counties is a major habitat for nesting, migrating, and wintering waterfowl. Also, the Howrey Island ACEC is a large island in the Yellowstone River in Treasure County that provides valuable habitat for waterfowl and many other species.

In Blaine County there are a number of large and small wetlands within the coal area that are important to waterfowl and shorebirds. These include North Chinook Reservoir and the Holm Waterfowl Production Area about 20 miles north-northwest of Chinook, and Tule Lake and BR12, about 10 miles north of Zurich. Smaller wetlands in this area are collectively extremely important. This is an important nesting area for northern pintails, a species of duck that has declined in numbers.

Raptors

Many of the raptors occurring in the planning area have been identified by the State of Montana, the USFS, or BLM as sensitive species or species of special interest or concern (Flath 1991, Houtcooper et al. 1985). Those listed by the state include the ferruginous hawk (*Buteo regalis*), osprey (*Pandion haliaetus*), Cooper's hawk (*Accipiter cooperii*), northern goshawk (*Accipiter gentilis*), golden eagle (*Aquila chrysaetos*), merlin (*Falco columbarius*), prairie falcon (*Falco mexicanus*), burrowing owl, flammulated owl (*Otus flammeolus*), great gray owl (*Strix nebulosa*), and Boreal owl (*Aegolius funereus*). The endangered bald eagle (Haliaeetus leucocephalus) is discussed in the Species of Concern section.

Burrowing owls are of particular interest because of the rapid decline in their numbers (MT-GAP 1998). They occur in a variety of open habitat types, nesting and roosting in burrows dug by mammals (AOU 1983). They appear to be totally dependent on these mammal burrows with prairie dog towns providing prime habitat (MT-GAP 1998).

Ferruginous hawks occupy relatively undisturbed prairie and shrub steppe regions with scattered trees, rock outcrops, and wooded stream bottoms (Evans 1982, Clark et al. 1989). MFWP notes that there are a few pairs that apparently nest along tributaries in both the Powder River and Tongue River watersheds. Ferruginous hawks have declined throughout their range over the last 30 years. Merlins have also suffered substantial population declines. They occur in sparsely treed prairie, prairie parkland, along stream bottoms, and in grassland habitats. MFWP notes that merlin were present in the Powder River watershed, but that little current information is available.

Upland Game Birds

The following section from the Billings and Powder River RMPs describes habitat preferences and important natural history information for the prairie sharp-tailed grouse *(Tympanuchus phasianellus jamesi*) and greater sage grouse (*Centrocercus urophasianus*) that applies to the entire planning area. Sharp-tails are widely distributed and are generally found in the grassland, shrub-grassland, and woodland vegetation areas. Sharp-tail habitat includes hills, benchlands, and other areas of rolling topography that have good stands of residual cover composed chiefly of grasses for roosting, feeding, and nesting. Dancing grounds, or leks, are usually flat areas on elevated knolls or benches. The dancing or mating sites are nearly bare of vegetation, although brushy cover is located nearby for feeding and escape. The breeding and nesting period from March to June is the most critical period in the life cycle. Females nest and raise their broods in the grassy uplands, usually within 1 mile of mating grounds.

Studies in southwestern North Dakota have shown that more than 90 percent of the nest sites were in residual vegetation over 6 inches high, and 70 percent of brood locations were in vegetation over 9 inches high (Kohn 1976). Habitat preferences in this planning area are similar.

Sage grouse are discussed under *Species of Concern* later in this Wildlife section.

Neotropical Migrants

A wide variety of neotropical migrants pass through or breed in the planning area. Habitat types that would be

expected to support the highest species richness and highest breeding densities include cottonwood and ash riparian communities (Hopkins 1984) and emergent wetland communities. Hansen (2001) indicated that large blocks of native grasslands in Blaine County are very important to several species of birds that are declining in numbers, including Baird's sparrow (*Ammodramus bairdii*), Sprague's pipit *(Anthus spragueii*), chestnut-collared longspur (*Calcarius lapponicus*), and McCown's longspur (*Calcarius mccownii*). A number of other bird species, including the Brewer's sparrow (*Spizella breweri*), and loggerhead shrike (*Lanius ludovicianus*), are also declining throughout their range.

Reptiles and Amphibians

The MT-GAP (1998) indicates that the emphasis area supports 9 species of amphibians and 14 species of reptiles. These include 1 salamander, 4 frogs, 4 toads, 3 turtles, 2 lizards, and 9 snakes. MFWP has expressed particular concern about 5 of these species including the northern leopard frog (*Rana pipiens*), tiger salamander (*Ambystoma tigrinum*), hognose snake (*Heterdon nasicus*), milk snake (*Lampropeltis triangulum*), and the spiny softshell turtle (*Trionyx spiniferus*).

Leopard frogs have declined substantially in western, and to a somewhat lesser extent, central Montana (MT-GAP 1998). They are locally abundant in southeastern Montana (Reichel and Flath 1995). They are associated with permanent slow moving water bodies with considerable vegetation, but may also range into moist meadows and grassy woodlands and occasionally agricultural areas (Nussbaum et al. 1983). They are most often associated with riparian habitats and on prairies near permanent water. Tiger salamanders occur throughout the planning area wherever there is terrestrial substrate suitable for burrowing and a nearby body of water for breeding (MT-GAP 1998). All amphibians are particularly susceptible to adverse effects of water quality degradation because larval stages are spent in water and they absorb water through their skin during all life stages.

The western hognose snake occurs in a variety of habitats throughout central and eastern Montana. They are especially associated with arid areas, prairie grasslands and shrublands, and floodplains with gravely or sandy soils (Reichel and Flath 1995). Milk snakes occur in suitable habitats throughout south central and southeastern Montana. Preferred habitats include sandstone bluffs, rock outcrops, grasslands, and open ponderosa pine and juniper stands (Hendricks and Reichel 1996). The spiny softshell is a riverine species that occurs primarily in the larger rivers of southeastern Montana. It is found in well-oxygenated, slower moving water with nearby mud flats and sandbars, and occasionally in back water sloughs (MT-GAP 1998).

Species of Concern

This section discusses wildlife species of concern that occur in the planning area. These include species listed or proposed for protection under the ESA, species classified as sensitive by the BLM or Forest Service, and species considered to be critically imperiled in the State of Montana. Table 3-36 and the following discussion present information about the species protected under ESA.

Birds

Sage Grouse

Sage grouse are widely distributed in suitable habitat, but because their numbers have been declining throughout their range, including Montana, over the last 20 years they are a possible candidate for listing under the ESA. Sage grouse are primarily associated with big and silver sagebrush communities in grassland-shrub and shrub vegetation types. The importance of mature sagebrush with a good understory of grasses and forbs to sage grouse is well documented.

Sage grouse males appear to form leks opportunistically at sites within or adjacent to potential nesting habitat. Although the lek may be an approximate center of annual ranges for non-migratory populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1975), this may not be the case for migratory populations (Connelly et al. 1988, Wakkinen et al. 1992). Average distances between nests and nearest leks vary from 0.66 to 3.75 miles but documented distances from leks with which females were associated to their nests have exceeded 12 miles. (Autenrieth 1981, Wakkinen et al. 1992, Fischer 1994, Hanf et al. 1994, Lyon 2000). Nests are placed independent of lek location (Bradbury et al. 1989, Wakkinen et al. 1992). Nesting habitat is usually located under sagebrush, and with about 50 percent of nests located within 2 miles of leks (Wallestad and Pyrah 1974, Martin 1970).

TABLE 3-36
ENDANGERED, THREATENED, AND PROPOSED ANIMAL SPECIES PRESENT IN THE CBM EMPHASIS AREA

Common Name	Scientific Name	Habitat in Montana	Federal Status*
Birds			
mountain plover	*Charadrius montanus*	Arid, shortgrass prairieland in eastern Montana	PT
bald eagle	*Haliaeetus leucocephalus*	Forested riparian areas throughout the state	T
interior least tern	*Sterna antillarum athalassos*	Sandbars and beaches in eastern Montana and along the Yellowstone and Missouri rivers	E
Mammals			
gray wolf	*Canis lupus*	Adapted to many habitats, need large ungulate prey base and freedom from human influence	E/10(j)
black-tailed prairie dog	*Cynomys ludovicianus*	Short-grass and mixed-grass prairie in the east of the 110th Meridian; concentrations are in southern Phillips County, Custer County, Blaine County, Fort Belknap Reservation, and Crow Reservation	C
Canada lynx	*Felis lynx canadensis*	Montana spruce/fir forest in western Montana	T
black-footed ferret	*Mustela nigripes*	Prairie dog complexes in eastern Montana	E
grizzly bear	*Ursus arctos horribilis*	Alpine/subalpine coniferous forest in western Montana	T

*T = Threatened; E = Endangered; C = Candidate; PT = Proposed Threatened;
E/10(j) = Endangered/Experimental Populations.

Sagebrush provides 80 to 100 percent of their winter diet (Wallestad and Schladweiler 1975, Martin 1970, Eng and Schladweiler 1972). For winter, sage grouse prefer an area where sagebrush shrubs are at least 12 inches high (BLM 1995). Forbs, especially dandelion and salsify, are an important dietary component for the juveniles and adults in the spring and summer and wet meadows and other riparian areas are heavily used in the summer as sagebrush areas dry out.

Mountain Plover

This species has been proposed for listing as threatened. It was once widely distributed across short-grass prairies on the western Great Plains, occupying a range extending from Montana to New Mexico and Texas. Conversion of native prairies to agriculture has significantly reduced suitable breeding habitats for this species. It prefers level sites with very short grass and scattered cactus. Intensive grazing is beneficial for mountain plovers, and they also regularly occupy prairie dog towns. High, arid plains and shortgrass prairie with blue grama-buffalo grass communities are the primary habitat. The mountain plover does not winter in Montana, but may breed within the planning area, particularly in black-tailed prairie dog towns. It currently breeds in central, north-central, and southwest Montana and is transitory in other parts of Montana, such as the Greater Yellowstone Ecosystem. Blaine and Phillips counties currently support the bulk of mountain plovers that nest in Montana.

Bald Eagle

This species was reclassified from endangered to threatened, because of recovery status, on July 12, 1995. Bald eagles concentrate in and around areas of open water where waterfowl and fish are available. They prefer solitude, late-successional forests, shorelines adjacent to open water, a large prey base for successful brood rearing, and large, mature trees for nesting and resting.

Bald eagle recovery zones include the Powder and Missouri rivers. Bald eagles commonly nest along the Yellowstone River in Rosebud and Custer counties. The Yellowstone River is used during spring and fall migration. Peak occurrence is November through April. The Missouri, Yellowstone, Musselshell, and Powder rivers provide habitat during migration as well as during the winter months. Bald eagles currently are expanding their nesting territories down the Yellowstone River (Flath 1991).

Interior Least Tern

The historic distribution of the interior least tern is the major river systems of the plains states and midwestern U.S. The occurrence of breeding least terns is localized and is highly dependent on the presence of dry, exposed sandbars and favorable river flows that support a forage fish supply and isolate the sandbars from the riverbanks. Characteristic riverine nesting sites are dry, flat, sparsely vegetated sand and gravel bars within a wide, unobstructed, water-filled river channel. In the upper Missouri River Basin, it often nests with piping plovers. During spring and fall migrations, the least tern uses stockwater reservoirs (Flath 1991).

The least tern is known to nest in the planning area. Its habitat includes graveled islands in the lower Yellowstone River and the Missouri River below Fort Peck Dam.

Peregrine Falcon

The peregrine falcon was delisted on August 25, 1999, and protection from take and commerce for the peregrine falcon is no longer provided under the ESA. However, peregrine falcons are still protected by the Migratory Bird Treaty Act (MBTA). The MBTA and its implementing regulations (50 CFR parts 20 and 21) prohibit take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase, or barter any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit (50 CFR 21.11). With limited exceptions, take will not be permitted under MBTA until a management plan is developed in cooperation with state wildlife agencies, undergoes public review, is approved, finalized, and published in the FR.

Peregrine falcons migrate through the planning area during spring and fall, especially along rivers and other water bodies that support waterfowl and shorebirds. Peregrines are believed to nest northeast of Great Falls, possibly within the planning area.

Mammals

Gray Wolf

This species was listed as endangered on March 11, 1967. On November 18, 1994, the FWS announced that experimental populations of this species would be reintroduced in central Idaho and southwestern Montana. Populations classified as experimental are exempt from full endangered status. Historically, the gray wolf ranged throughout Montana. It appears to have been common throughout the state, inhabiting both short and tall grass prairie as well as forested regions. It has no particular habitat preference, but requires areas with low human population, low road density, and high prey density, which are ideally large, wild ungulates.

Most confirmed wolf sightings and pack accounts are for western Montana, along the Bitterroot divide, and in the areas around Yellowstone National Park, where it has been reintroduced (Fisher et al. 1998).

Black-tailed Prairie Dog

This species was proposed for listing as threatened on March 25, 1999. On February 3, 2000, the FWS determined that the black-tailed prairie dog warrants listing under the ESA. However, because there are other species also awaiting listing that are in greater need of protection, the FWS is not proposing to list the species at this time, but it still remains a candidate for listing.

Although the original abundance of prairie dogs in Montana is unknown, early accounts indicate they were abundant and widely distributed east of the Continental Divide in grasslands and sagebrush-grasslands. This species is capable of colonizing a variety of shrub-grassland and grassland habitats. Generally, the most frequently used habitats in Montana are dominated by western wheatgrass, blue grama, and big sagebrush and located in relatively level areas in wide valley bottoms, rolling prairies, and the tops of broad ridges. The black-footed ferret is an obligate predator of prairie dogs. Other species with close associations to prairie

dogs are burrowing owls, mountain plovers, and ferruginous hawks. These are all species of concern.

Canada Lynx

This species was listed as threatened on March 24, 2000. It is dependent on snowshoe hares and found in the same habitats, which include dense, mature old-growth lodgepole pine, Douglas fir, Engelmann spruce, and subalpine fir forest. Distribution and primary potential habitats for Montana are in the western portion of the State in mature coniferous forests with a well-developed understory. Dens are primarily located in mature lodgepole pine and spruce-fir forests.

Black-footed Ferret

This species was listed as endangered on March 11, 1967. Black-footed ferrets depend almost exclusively on prairie dogs for food and shelter. They primarily prey on prairie dogs and use their burrows for shelter and dens. Ferret range is coincident with that of prairie dogs. There is no documentation of black-footed ferrets breeding outside of prairie dog colonies. There are specimen records of black-footed ferrets from ranges of three species of prairie dogs: the black-tailed prairie dog (*Cynomys ludovicianus*), white-tailed prairie dog (*Cynomys leucurus*), and Gunnison's prairie dog (*Cynomys gunnisoni*).

Several releases of black-footed ferrets have taken place over the last four years on public land and the Fort Belknap Indian Reservation north of the planning area in Phillips County, Montana.

Grizzly Bear

This species was listed as threatened on March 11, 1967. On November 11, 2000, the FWS listed some populations in Montana and Idaho as experimental in order to facilitate restoration to designated recovery areas. The grizzly (or brown) bear was once found in a wide variety of habitats including open prairie, brushlands, riparian woodlands, and semidesert scrub. Its distribution in Montana is now limited to the Northern Continental Divide Ecosystem and the Yellowstone Ecosystem with a few in the Cabinet-Yaak Ecosystem. Scattered individuals may occur in the mountainous areas of western Montana. It no longer exists in the wild in eastern Montana. Most populations require vast areas of suitable habitat to prosper. This species is common only in habitats where food is abundant and concentrated, including white-bark pine, berries, and salmon or cutthroat runs, and where conflicts with humans are minimal.

State Species of Special Concern

In addition to species that are federally protected under the ESA, the State of Montana has designated additional species of concern within its jurisdictional boundaries. There are five rankings for State Species of Special Concern. This document focuses only on the highest ranking (S1). This ranking is defined as critically imperiled because of extreme rarity (five or fewer occurrences, or very few remaining individuals), or because some factor of its biology makes it especially vulnerable to extinction.

State-listed species (with BLM and USFS rankings) that have potential distributions within the 16-county emphasis area of this EIS or that have undefined distributions in the state are listed in the Wildlife Appendix, *Wildlife Species of Concern* (see Table WIL-1 for Special Status Species of State of Montana, BLM, and USFS). Species that are federally listed under the ESA have been omitted from these tables because they have been considered. Table WIL-1 also lists vertebrate species that are species of concern for the state, BLM, or the USFS.

Aquatic Resources

Aquatic habitat in the CBM emphasis area that supports, or could potentially support, fisheries and other aquatic resources briefly described in the following paragraph includes rivers, streams, lakes, and stock ponds. Extensive information on aquatic habitat and fisheries resources in the Billings and Powder River RMP areas and in Gallatin, Park, and Blaine counties is contained in the Montana NRIS on the Internet at http://nris.state.mt.us/wis/mris1.html (Montana NRIS 2001).

Tables WIL-2 through WIL-5 in the Wildlife Appendix summarize representative planning area information from the Montana NRIS (2001) Internet data base. Table WIL-2 summarizes aquatic resources characteristics of major drainages and representative tributaries within the boundaries of each RMP area and county. These characteristics include drainage length, aesthetics, fisheries management, fisheries resource value, number of fish species present, and whether a dewatering problem has been identified. The relative abundances of fish species present in major drainages and representative tributaries are summarized in Table WIL-3 (Billings RMP area), Table WIL-4 (Powder River RMP area), and Table WIL-5 (Park, Gallatin, and Blaine counties). The scientific names of fish species discussed in the following text are given in Tables WIL-3, WIL-4, and WIL-5.

Numerous other aquatic resources besides fish are present in emphasis area water bodies. These resources often are important in the diet of various species of fish, or they comprise part of the food web that fish ultimately depend on in their diet. Examples of other aquatic resources include benthic macroinvertebrates and microinvertebrates, zooplankton, phytoplankton, periphyton (attached algae), snails, clams, and worms. Numerous taxa of aquatic insects whose distribution and abundance vary with geographic location, habitat type, and habitat condition occur in planning area drainages. Immature and adult forms of Plecoptera (stoneflies), Ephemeroptera (mayflies), Trichoptera (caddisflies), and Diptera (true flies) are particularly important in the diets of juvenile and adult trout, whitefish, and other native fish species.

Fish and other aquatic species that have been listed, proposed, or are candidates for listing as federally endangered or threatened species, or have otherwise been designated as federal or state sensitive species or species of concern, are discussed under Special Status Species in this Aquatic Resources section.

Billings RMP Area

Major rivers and streams in the Billings RMP area are the Yellowstone River and its tributaries in the southern two-thirds of the area, and the Musselshell River and its tributaries in the northern one-third of the area. Both of these rivers eventually drain to the Missouri River outside of the RMP area. Major tributaries to the Yellowstone River are the Boulder, Stillwater, Clarks Fork of the Yellowstone, and Bighorn rivers. Careless Creek is a major tributary to the Musselshell River. Each of the referenced drainages is characterized by a dendritic pattern of tributaries, with flows ranging from perennial to ephemeral (MBOGC 1989). Examples of other water bodies that provide important habitat for aquatic resources in this resource management plan are Bighorn Lake, Cooney Reservoir, Big Lake, Lebo Lake, numerous mountain lakes at higher elevations, and miscellaneous water bodies such as storage reservoirs and stock ponds.

The Billings RMP area drainages listed in Table WIL-2 have been characterized as ranging from "national renown" in the more upstream reaches to "stream and area fair" in some of the downstream reaches (Montana NRIS 2001). Designated fisheries management in these drainages is for trout, except in the Yellowstone River east of Billings (managed for warm/cool water and non-trout species) and in the downstream section of the Clarks Fork of the Yellowstone (managed for non-trout species) (see Table WIL-2). The fisheries resource value in these drainages is outstanding, high, or substantial, except in the Little Bighorn River (moderate value) and Careless Creek (moderate or limited value in some reaches). The greatest numbers of fish species are generally found in the more downstream reaches of larger drainages, with comparatively fewer species present in the more upstream, or upstream reaches of, tributaries. Numbers of fish species present vary from 32 in the Musselshell River, 28 in the Yellowstone River east of Billings, 20 in the Yellowstone River west of Billings, 9 in the Boulder and Stillwater rivers, and 8 in the Little Bighorn River (see Table WIL-2).

Table WIL-3 provides detail about the relative abundance of fish species collected from each of the Billings RMP area drainages listed in Table WIL-2. Many of the same fish species are abundant or common in many of these drainages, although there is a pattern, proceeding downstream, of increased species diversity and the replacement of predominantly cold-water species by cool and warm water species. Examples of abundant or commonly occurring game fish in the Yellowstone River west of Billings are rainbow trout, brown trout, mountain whitefish, and burbot (ling); abundant or common non-game fish species in this reach of the Yellowstone River include, among others, goldeye, longnose sucker, white sucker, mountain sucker, shorthead redhorse, and mottled sculpin (see Table WIL-3).

The same species of trout and whitefish, as well as Yellowstone cutthroat trout and brook trout, also are abundant or common in the Boulder and Stillwater rivers. By comparison, these same species of salmonids are either uncommon in occurrence or absent from the mainstem Yellowstone River east of Billings. Instead, game fish typically associated with cool or warm water regimes—such as channel catfish, northern pike, smallmouth and largemouth bass, yellow perch, sauger, and walleye—first appear in river collections or are more abundant than farther upstream (see Table WIL-3).

Fish species present in the Clarks Fork of the Yellowstone and in the Bighorn River generally represent a subset of fish species present in nearby reaches of the Yellowstone River. There are more fish species present in the downstream sections of the Clarks Fork (19 species) and the Bighorn (30 species) than in their upstream sections (12 species in the Clarks Fork and 17 species in the Bighorn) (see Table WIL-2). Rainbow trout, brown trout, and mountain whitefish are present in both sections of the Clarks Fork and Bighorn rivers, but these species are more abundant in the upstream than downstream sections (see Table WIL-3). Yellowstone cutthroat trout also are present in

the Clarks Fork, and Arctic grayling are present in the upstream section of the Clarks Fork. Other game species present in these two drainages include channel catfish, burbot, and sauger in the downstream section of the Clarks Fork, and channel catfish, northern pike, burbot, smallmouth bass, sauger, and walleye in both sections of the Bighorn River. The Little Bighorn River, which is tributary to the downstream section of the Bighorn River, supports five commonly occurring game fish species, including rainbow trout, brown trout, mountain whitefish, channel catfish, and smallmouth bass (see Table WIL-3).

A variety of 32 fish species are present in the Musselshell River within the Billings RMP area (Table WIL-2). More than half of these species have been rated as abundant or common in occurrence in various fisheries studies conducted on this drainage (see Table WIL-3) (Montana NRIS 2001). Examples of game species present in the Musselshell, which is managed as a trout fishery within the RMP area, include brown trout, mountain whitefish, channel catfish, black bullhead, northern pike, smallmouth bass, sauger, and walleye. Examples of dominant non-game species present in the Musselshell are goldeye, common carp, sand shiner, flathead chub, longnose dace, longnose sucker, white sucker, mountain sucker, shorthead redhorse, and mottled sculpin. The 10 species of fish present in Careless Creek, a tributary to the Musselshell, are dominated by non-game fish, such as lake chub, flathead chub, longnose dace, and white sucker. The only game fish reported from Careless Creek is brook trout, which is common in occurrence (see Table WIL-3).

Some of the storage reservoirs and stockponds in the Billings RMP area, and in other planning area reservoirs and stockponds, have been stocked with various game fish species. Examples include northern pike, largemouth bass, yellow perch, walleye, bluegill, crappie, and rainbow trout (MBOGC 1989, BLM 1995). Rainbow trout must be restocked regularly because they will not reproduce in ponds, but other species such as bass, perch, bluegill, and crappie may establish self-sustaining populations in ponds.

Water quality in perennial rivers and streams within the Billings RMP area is generally good. Water quality in the Yellowstone River has been rated as good for wildlife uses, while water quality in the Musselshell River has been rated as satisfactory for wildlife uses (BLM 1995). The BLM (1995) also reported that the area's semiarid climate is not conducive to maintaining fish habitat and populations in most intermittent streams. However, Regele and Stark (2000), citing the Montana Fish, Wildlife, and Parks (MFWP), stated that perennial as well as intermittent prairie streams in southeastern Montana are important in the life histories of native fish species and often provide spawning and rearing habitat for mainstem fish species.

Powder River RMP Area

Major rivers and streams that comprise important aquatic habitat in the Powder River RMP area are the Yellowstone River and its tributaries in the western two-thirds of the area, and the Little Missouri River and its tributaries in the eastern one-third of the area. All of these rivers eventually drain to the Missouri River outside of the RMP area. Major tributaries to the Yellowstone River are the Tongue (and Tongue River Reservoir), Little Powder, and Powder rivers, and Rosebud, Pumpkin, Otter, Armells, Hanging Woman, and Mizpah creeks. Box Elder Creek is a tributary to the Little Missouri River. The referenced drainages are characterized by a dendritic pattern of perennial and ephemeral tributaries (MBOGC 1989). Examples of other water bodies that provide habitat for aquatic resources in this RMP area are lakes, storage reservoirs, and stock ponds.

The Powder River RMP area drainages listed in Table WIL-2 have been characterized as typically ranging from "clean stream and natural setting" to "stream and area fair," although the Powder River varies from "natural and pristine beauty" in the upstream section to "low" in the downstream section (Montana NRIS 2001). Fisheries management in these drainages is for non-trout species, warm/cool water species, or has not been designated, except in the upstream section of the Tongue River where designated fisheries management is for trout. The fisheries resource value in most of these drainages is high, substantial, or moderate, except in some reaches of Pumpkin and Mizpah creeks that have limited fisheries resource value. The greatest numbers of fish species are generally found in the more downstream or downstream reaches of larger drainages, with fewer species present in the more upstream or upstream reaches of smaller tributaries. Numbers of fish species present vary from 40 in the Yellowstone River and 33 in the downstream section of the Tongue River to 13 in the Little Powder River and 18 in the Little Missouri River (see Table WIL-2).

Table WIL-4 provides detail on the relative abundance of fish species collected from many of the Powder River RMP area drainages listed in Table WIL-2. The number of fish species in this reach of the Yellowstone River (40 species) is considerably greater than in the Yellowstone within the Billings RMP area east of Billings (28 species) and west of Billings (20 species). The most abundant game fish in the Yellowstone River

in the Powder River RMP area are shovelnose sturgeon, paddlefish, channel catfish, burbot, sauger, and walleye. Lesser numbers of a wide variety of other game species also are present, such as northern pike, various sunfishes, smallmouth and largemouth bass, white and black crappie, and rainbow and brown trout. Examples of some of the more abundant non-game species in the Yellowstone are goldeye, common carp, emerald shiner, flathead chub, river carpsucker, white sucker, shorthead redhorse, and stonecat. The federally listed endangered pallid sturgeon occurs rarely in the Yellowstone River within this RMP area (see Table WIL-4).

Species present in tributaries to the Yellowstone River within the Powder River RMP area generally overlap with those species present in the mainstem Yellowstone. However, species composition in the tributaries is less diverse overall, particularly in the smaller drainages and in the upstream sections of drainages (see Table WIL-4). Some of the fish species dominant in the Yellowstone also are prominent in sections of the Tongue and Powder rivers. Examples include shovelnose sturgeon, channel catfish, sauger, goldeye, common carp, flathead chub, white sucker, and shorthead redhorse. Other game species present in the Tongue and Powder rivers include northern pike, walleye, several species each of bullheads, sunfishes, and crappies in the Tongue River; burbot, green sunfish, and walleye in the Powder River; and rainbow and brown trout, which are uncommon in occurrence, in the upstream sections of the Tongue and Powder rivers (see Table WIL-4). Smallmouth bass, a popular cool water game fish, have been captured at various locations throughout the Tongue River, and are reported to be abundant in Tongue River Reservoir (Montana NRIS 2002).

Considerably fewer game species are present in the smaller Powder River RMP area tributaries listed in Table WIL-2. For the following tributaries, the only game species reported as common in occurrence are channel catfish, northern pike, burbot, and sauger in Rosebud Creek, which drains directly to the Yellowstone; channel catfish in Pumpkin Creek, which is tributary to the downstream section of the Tongue River; and channel catfish in the Little Powder River, which is tributary to the downstream section of the Powder River (Montana NRIS 2001) (see Table WIL-4). The Little Missouri River, which empties into the Missouri River and contains 18 fish species, supports four game species, including channel catfish, black bullhead, green sunfish, and sauger (see Table WIL-4).

Water quality conditions and concerns in perennial, intermittent, and ephemeral drainages in the Powder River RMP area are generally similar to those described for drainages in the Billings RMP area. Water quality in the Yellowstone and Powder rivers has been rated as good for wildlife uses (MBOGC 1989).

Elser et al. (1980) reported the results of extensive fisheries investigations conducted on numerous large and small drainages in southeastern Montana. The authors found that the lower Yellowstone River in this part of the state supports a diverse, productive fishery that is dependent on adequate flows and good water quality. Elser et al. (1980) reported that in the Tongue River, fish populations range from a cold water-mixed population downstream of the dam at Tongue River Reservoir to an assemblage of slow-water species downstream near the river's mouth. They added that migrant fish species from the Yellowstone River depend on high spring flows to allow good passage into the Tongue River. Elser et al. (1980) noted that fish populations in the Powder River are limited in diversity and abundance because of water quality and water quantity conditions. Fish populations are probably limited for similar reasons in the Little Missouri River, which Elser et al. (1980) described as having highly erratic flows, fair to poor water quality, very hard water, and moderate to high turbidities.

Park, Gallatin, and Blaine Counties

Various water bodies provide important aquatic habitat and sustain valuable fisheries in Park, Gallatin, and Blaine counties. Important habitat in Park County includes the Yellowstone River as it flows north from Yellowstone National Park, tributaries to the Yellowstone such as Shields River, and numerous mountain lakes. The Yellowstone River in Park County is of "national renown," is managed for its trout fishery, and has an outstanding fisheries resource value (see Table WIL-2). Shields River has been characterized as a "clean stream in a natural setting," is managed for its trout fishery, has a high to substantial fisheries resource value, but also is periodically dewatered (Montana NRIS 2001).

The Yellowstone River in Park County supports 12 species of fish. Yellowstone cutthroat trout, rainbow trout, brown trout, and mountain whitefish are the dominant game species, with longnose sucker, white sucker, longnose dace, and mottled sculpin among the dominant non-game species (see Table WIL-5). Shields River, with 10 fish species, generally supports the same assemblage of dominant cold-water game and non-game fish as the Yellowstone River. Water quality in the referenced Park County drainages, and in drainages in Gallatin and Blaine counties discussed in the

following text, generally tends to be good to excellent, primarily because of the proximity to headwaters or the often undeveloped or remote nature of the surrounding areas.

Major drainages in Gallatin County include the Gallatin, Madison, and Jefferson rivers and their tributaries, which combine to form the Missouri River. These rivers and streams are managed for, and support, nationally renowned trout fisheries that have either an outstanding, high, or substantial fisheries resource value (see Table WIL-2). The Gallatin County drainages vary from "national renown" to "clean stream and natural setting." However, periodic dewatering problems have been identified for portions of the Missouri and Gallatin rivers, and chronic dewatering problems have been identified for portions of the Jefferson and Gallatin rivers (Montana NRIS 2001).

The relative abundance and kinds of fish species present in the referenced Gallatin County drainages are similar, varying from 13 species in the Missouri and Madison rivers to 12 species in the Jefferson and Gallatin rivers. Dominant game fish include brown trout, rainbow trout, and mountain whitefish, with dominant non-game fish consisting of longnose sucker, white sucker, longnose dace, and mottled sculpin. Other less abundant cold-water game species present in some of these drainages include Yellowstone cutthroat trout, westslope cutthroat trout, brook trout, and Arctic grayling. Table WIL-5 provides further information on fish species present and their relative abundance in these drainages. In addition, sicklefin chub (*Macrhybopsis meeki)* occur in the Missouri River in Gallatin County. The FWS found that listing this species is not warranted, although significant concern for this species remains (FWS 2001).

Important aquatic habitat in Blaine County includes the Missouri River and its tributaries, such as Cow Creek, in the southern half of the county, as well as the Milk River and its tributaries, such as Lodge and Peoples creeks, in the northern half of the county. The Milk River empties into the Missouri River east of Blaine County. Examples of other water bodies that provide important aquatic habitat in Blaine County are North Chinook Reservoir and Putnam Lake. The Missouri River in Blaine County is of "national renown," is managed as a non-trout fishery, and has an outstanding fisheries resource value (see Table WIL-2). Its tributaries in Blaine County have been characterized as of "clean stream and natural setting" or "stream and area fair," and have a fisheries resource value of high, substantial, or moderate. Cow Creek and part of Peoples Creek are managed as trout fisheries, while the Milk River, Lodge Creek, and part of Peoples Creek are managed for non-trout species (Montana NRIS 2001).

The numbers of fish species present in Blaine County drainages listed in Table WIL-2 vary from 31 in the Milk River and 26 in the Missouri River to eight in Cow Creek (see Table WIL-5). Many of the same fish species are abundant or common in the Missouri and Milk rivers and are dominated by species with warm or cool water preferences. Examples include goldeye, common carp, emerald shiner, flathead chub, longnose dace, and stonecat. Examples of other commonly occurring species in these drainages include shovelnose sturgeon, western silvery/plains minnow, longnose sucker, channel catfish, and sauger in the Missouri River, and lake chub, northern redbelly/finescale dace, white sucker, burbot, yellow perch, sauger, and walleye in the Milk River. Sicklefin chub also occur in the Missouri River in Blaine County. Of the eight species present in Cow Creek, which is managed as a trout fishery, only brook trout occur in abundance. Examples of commonly occurring species in Lodge and Peoples creeks include: lake chub, common carp, fathead minnow, black bullhead, northern pike, and yellow perch in Lodge Creek; longnose dace, redside shiner, brook trout, and mottled sculpin in Peoples Creek; and white sucker and western silvery/plains minnow in both creeks. The federally listed endangered pallid sturgeon occurs rarely in the Missouri River within Blaine County (see Table WIL-5).

Special Status Species

Many federally listed threatened, endangered, or candidate species of special concern exist in the planning area that are given special consideration under Section 7(c) of the ESA of 1973. As required by the ESA, the FWS has provided a list of endangered, threatened, and proposed species that may be present in the planning area. This section reviews the habitat requirements of the three special status aquatic species identified by the FWS (see Table 3-37), as well as the likelihood of them being found in the 16 counties that may be potentially affected by this project.

TABLE 3-37
SPECIAL STATUS AQUATIC SPECIES PRESENT IN THE CBM EMPHASIS AREA

Common Name	Scientific Name	Habitat in Montana	Federal Status*
Fish			
Montana Arctic grayling	*Thymallus arcticus*	Fluvial populations in the cold-water, mountain reaches of the Upper Missouri River	C
Pallid sturgeon	*Scaphirhynchus albus*	Bottom dwelling fish of the Missouri and Yellowstone rivers	E
Invertebrates			
Warm spring zaitzevian riffle beetle	*Zaitzevia thermae*	Warm springs in Gallatin County	C

*E = Endangered; C = Candidate.

Montana Arctic Grayling

This species is a candidate for listing under the ESA. On October 2, 1991, a petition requested that the "fluvial Arctic grayling" be listed as an endangered species throughout its historic range in the lower 48 states. The petitioners stated that the decline of the fluvial Arctic grayling was a result of many factors, including habitat degradation as a result of the effects of domestic livestock grazing and stream diversions for irrigation, competition with nonnative trout species, and past overharvesting by anglers.

Additionally, the petition stated that much of the annual recruitment is lost in irrigation ditches. Historically, this species was widely, but irregularly, distributed and locally abundant above Great Falls in the upper Missouri River drainage in Montana (FWS 1994c).

Pallid Sturgeon

This species was listed as endangered on September 6, 1990 (55 FR 36641). They evolved in large rivers with high turbidity and a natural hydrograph consisting of spring flooding and other natural highwater events. Historically in Montana, they occupied reaches of the Missouri River from Fort Benton downstream and in the Yellowstone River from Miles City to the Missouri River (FWS 1993). There are three priority recovery management areas in Montana, two on reaches of the Missouri and one on the Yellowstone River.

Warm Spring Zaitzevian Riffle Beetle

This species is a candidate for listing. This species is only known to inhabit a single warm springs in Gallatin County near the City of Bozeman.